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ELECTROMAGNETIC THEORY AND ELECTRICAL ENGINEERING.

To anyone who heard Prof. M. I. Pupin lecture before the American Institute of Electrical Engineers, Maxwell's theory of electromagnetism must have seemed a very simple matter indeed. Like most things which seem complicated when new, familiarity with their application has at least made the fundamentals of the Maxwellian theory seem almost commonplace. And yet nearly a generation was required for the significance of Maxwell's theory to be recognized and for the important secrets which were contained in it to be appreciated and applied.

Apart from its bearing upon the subject of light and radiation in general, Maxwell's work served not only to put the then known facts regarding electrical phenomena into a comprehensive shape, but it enabled deductions to be made for which the experimental evidence was not then at hand. It indicated, for instance, the existence of electromagnetic waves, yet the world waited for Hertz to demonstrate the physical existence of such waves and for Marconi to apply them commercially.

Professor Pupin's exposition of the Maxwellian theory, a synopsis of which will be found elsewhere in this issue, was based upon the application of the third law of Newton to electric and magnetic phenomena. This law, which was formulated with respect to the motions of ordinary matter and the forces acting upon it, states that every action is opposed by an equal reaction. The realization that in the case of electromagnetic phenomena, mechanical forces often come into play to which there is no reaction in the purely mechanical sense, has led many persons to believe that Newton's law finds here an exception and that it is not valid in this realm. In order to retain it we must adopt the conception of space having such attributes that it can possess momentum and energy. The conception of a mass which varies with the velocity is another that does violence to our mechanical ideas based upon the Newtonian philosophy. The student of electrical phenomena nowadays must be prepared to modify the old ideas along such lines as this, just as the chemist has been compelled recently to abandon the idea that the atom of matter is indivisible, and that one chemical element may not be transmuted into another.

As Professor Pupin pointed out, it is not sufficient for the electrical engineer to confine his atten-

tion only to that portion of electromagnetic theory which deals with conductors. His field is concerned with phenomena in which the electron plays an important part and if he is to understand all the phenomena which are to be applied in engineering work, it is necessary for him to keep abreast of the latest developments in physical science which bear upon electric and magnetic phenomena.

USE OF FAN MOTORS FOR VENTILATING SLEEPING APARTMENTS.

The balmy days of spring are now fully at hand and, while they inspire many to thoughts of poetry and love, they also suggest to the more practical among us that torrid and sultry days are not far off and that with them will come the urgent need for the delightfully cooling breezes of the electric fan. The use of the fan motor as a cooling agent has become so fixed in the public mind that it has even been mentioned in popular midsummer songs. Not so well known, however, is the use of this fan as a ventilating means.

In but relatively few houses is any positive ventilation equipment provided, dependence being placed almost entirely on opening of windows. Wind is the most active natural ventilating agency, but at the same time the most uncontrollable and therefore unreliable. In cold weather, when there is a considerable difference between outdoor and indoor temperatures, natural convection currents will bring fresh air in at the bottom of a window and remove vitiated air at the top. Such currents will provide more or less perfect ventilation, depending upon the conditions; they serve in the absence of wind or may co-operate with wind. In warm weather, when the difference between outdoor and indoor temperatures is very small or negligible, convection currents fail and reliance must be placed entirely on wind, since diffusion through the restricted areas of most windows, even when wide open, serves to improve the quality of only that air close to the windows. This is the time to use the electric fan to bring in fresh air when the wind is absent or in the wrong direction.

There are many days in summer when there is practically no breeze. Even when there is more or less breeze, rooms on the leeward side get no appreciable benefit from it, as a rule. The result is that such rooms become stuffy and uncomfortable. This is particularly noticeable during damp or sultry weather, even when the outdoor temperature is not excessively high. The habitability of all kinds of rooms can be improved when these conditions prevail by placing an electric fan on or close to the sill of an open window and turning it so that it will blow fresh air into the room. In bedrooms this plan his been found to work out particularly well, since its use permits refreshing sleep for even those who cannot avail themselves of the luxury of an open sleeping porch.

In using an electric fan in the manner suggested above, some precautions are necessary. One of these, which is self-evident, is to be sure that the window curtains are well draped to the sides of the window so as to avoid entanglement in the fan if a gust of wind should suddenly spring up. Another is to use a fan of such size and to run it at such speed as will not produce a chilling draft. For a very small room an eight-inch fan will usually suffice; for larger rooms a twelve-inch fan is generally needed. Nonoscillating fans serve very well, since the fan should be so directed as to produce a gentle but steady breeze. The fan should not be too near the sleeper, if the latter is subject to catching colds. All that is needed is to bring a steady current of fresh air that is strong enough to reach the breathing zone. A long cord is usually necessary to permit placing the fan on or close to the window sill and a feed-through switch placed in the cord so as to be readily reached without getting out of bed is a convenience for stopping the fan if a natural breeze springs up. The fear that some may have of possible noise from the fan is unwarranted if a quietly running fan is used; in fact, the very slight hum of the fan running at low speed has been found quite soothing.

The cost of operating a fan all night under these conditions is so small compared to the benefits it brings in sound and restful sleep that no one should hesitate on account of expense. To the central-station companies, on the other hand, the revenue derived from having a large number of fans operating all night will be welcome.

THE PAGEANT AND MASQUE OF ST. LOUIS.

Elsewhere in this issue there is given a description of the electrical details of the huge three-day Pageant and Masque of St. Louis. A temporary installation for electrical illumination and effects in a natural amphitheater of the size of the one on Art Hill, represents a problem of no mean proportions, yet no pains are being spared to eliminate unsightly wires and to remove all glare from the illumination.

It is interesting to note that the designers of this installation have recognized the excellent adaptability of the searchlight for general illumination, and have, at the same time, made provision for the failure of one or more of the main searchlights, by so directing the rays of the lamps that they overlap. The shielding of the two auxiliary 18-inch searchlights by installing them in pits, is a feature which is in line with the present tendency to shield light sources from view.

The stage illumination also presents a number of unique features in that it was obviously objectionable to use an overhead system of illumination wherein the lamps would be visible to the audience. The problem was solved by supplementing careful study of the requirements with experiment. When it was discovered that all types of footlight reflectors were objectionable for the purpose at hand, the designers did not, as so often happens, select the least objectionable, but developed a suitable reflector. Similarly, when it was found that theater dimmers in the large capacities required, would be prohibitive on

account of their cost, water rheostats were substituted.

The simplicity of the wiring layout is also noticeable, the control being centralized at one point on the stage. From this point directions can be given to the various searchlight operators by telephone, and an assistant stage manager in the audience can, by the same means, communicate to the stage a knowledge of any deficiencies in the electrical effects.

COLORADO AND CONSERVATION.

Recent events in Colorado lend strong support to a federal policy of retaining federal control over such natural resources of the country as now constitute public lands. By permitting coal mining, timber cutting, the development of water powers and other utilizations of natural resources under contract or lease rather than by turning title over to individuals or corporations the Federal Government may retain control and prevent such abuses as have become evident in the Colorado coal fields. It has been maintained by those who clamor for state rights and local control that the state is amply able to protect the public welfare and that it is better for the Federal Government to relinquish all control and keep hands off. No one has been more insistent upon this side of the question than the officials of Colorado, and yet it is in that state that we find the most manifest inability of the state administration to carry out the statutes which have been enacted for the public welfare.

If anyone doubts the failure of the state government of Colorado to properly perform its function he may find plentiful evidence in official records. Evidence presented before the investigating committee of the United States Congress was to the effect that a number of the demands for which the coal miners struck are already required by state law, but that the state laws are ignored by many of the mine operators and are not enforced by the state executive. A meeting of newspaper editors representing 25 of the leading papers of Colorado on November 13 last, in Denver, adopted resolutions asserting that four of the seven demands made by the miners were already required by statute. The report of the deputy state labor commissioner to the Governor of Colorado in 1911 contains the following statement referring to the Colorado Fuel & Iron Company: "It has been the policy of this company to violate all the laws on the statute books of Colorado that have for their purpose the protection of the wage earners."

Similar evidence regarding many of the coal-mining operations in the state are to be found in the reports of the state factory inspector and the Bureau of Labor Statistics.

It is not only employers and employees who have an interest in such conditions. Not only is there a public interest in the interruption of supply of such an article of general use as coal, but inconvenience, damage and financial loss have been incurred by large numbers of noncombatants. The question is, therefore, a larger one than merely that of securing the legal rights of those most directly involved in the conflict lately raging.

At about the time that the Ludlow massacre was taking place, the Governor of the state was in Washington and spoke for two days against the bill providing for the leasing of coal lands now included in the public domain, and almost in the same breath he called for the assistance of the Federal Government to maintain public order in the territory where trouble is largely due to his failure to enforce state laws. If the Government retains control of the present public lands it will not in future be necessary to send troops upon them in order to suppress disorder resulting from the development of those resources under conditions which are prohibited by law.

The coal miners of Colorado consist largely of ignorant immigrants. Their first contact with industrial conditions in their new country reveals the open violation of the laws by their employers with no redress upon their side, except through the medium of violence. The violators of law are immune from punishment because of their participation in politics and control not only of the chief state offices but also of the local government. Conditions could not be better selected for the breeding of anarchists. When anarchists occupy public office and manage the corporations having large property interests and dominating industrial operations, can we be surprised at their rapid development in the ranks of the workers? The Governor of the state is not personally so greatly to blame as might seem upon the surface, and his proposed impeachment would do little to improve conditions so long as politics are dominated by interests which do not want the law enforced. It is the meddling of powerful corporations in politics which is largely responsible for the ever increasing demand for government ownership rather than the question of whether better service and rates will be attained under the one or the other control. Unless the officials of large industrial corporations and utility corporations stop interfering with the enforcement of law and set an example as law-abiding citizens, they can hardly expect a temper among the electorate which will much longer regard the protection of property as one of the chief aims of organized government. The best means of preventing the spread of either anarchistic or socialistic ideas is to eliminate the causes that naturally give rise to them.

While the Federal Government has not been entirely free from domination by large interests, the liability of its action being so controlled is much more remote than in the case of individual states. It would, therefore, seem obvious that such conditions as now exist in Colorado can be much more easily obviated by retaining federal control of the public domain and providing for development of its resources without giving up federal title. At present only three per cent of the known coal lands of Colorado are privately owned. The state controls a large acreage, and title to about 11,000,000 acres resides in the Federal Government. Under present conditions it does not seem desirable to turn this over to either private or state ownership.

Electrical Exports for March.

The bureau of Foreign and Domestic Commerce has issued its monthly summary of the imports and exports of the United States for March. From this report are taken the following facts relative to the electrical exports for that month.

Although the total value of electrical shipments was larger in March than during the preceding month, a considerable decrease is evident as compared with March of last year, due largely, no doubt, to the practical cessation of exports to Mexico, which has heretofore been a good market for American electrical goods. The number of articles shipped in March in the four classes for which the numbers are reported were: fans, 3,662; arc lamps, 171; carbon-filament lamps, 79,301; metal-filament lamps, 56,429.

The detailed figures are given in the following table, together with those of the corresponding month in 1913, as far as the latter are available.

Articles	March, 1914	March, 1913
Batteries	$ 47,304	.....
Dynamos and generators	376,985	$ 136,812
Fans	54,718	43,460
Insulated wire and cables	154,696	.....
Interior wiring supplies, etc. (including fixtures)	50,182	.....
Lamps—		
Arc	2,686	9,186
Carbon-filament	14,697	19,423
Metal-filament	14,188	26,085
Motors	292,991	381,583
Static transformers	92,903	.....
Telegraph instruments (including wireless apparatus	6,062	17,774
Telephones	59,295	120,181
All other	937,625	1,734,870
Total	$2,104,332	$2,489,3.4

May Meeting of Electric Vehicle Association of America.

An important meeting of the Electric Vehicle Association of America is scheduled for Friday, May 22, at 8:15 p. m. This meeting is to be held in the new Auditorium, through the courtesy of the Consolidated Gas Company, 130 East Fifteenth street, New York City, and will be devoted to the subject "The Electric Vehicle in Parcel Post Service for Economy and Reliability."

The general subject will be presented by S. G. Thompson, of the Public Service Electric Company, of Newark, N. J. Frank W. Frueauff, chairman, Parcel-Post Co-operative Committee, will present the workings of his committee, discussing the subject from the viewpoint of the electricity-supply companies. James H. McGraw, chairman, Parcel-Post Delivery Committee, Electric Vehicle Association, will, in indicating the work accomplished by his committee.

A number of the prominent persons identified with the electric vehicle industry will discuss the subject and a large representative attendance is expected. The meeting is open to all.

Owing to the greatly increased interest in electric vehicles, and the great volume of work to be disposed of, three days will be allotted to the fifth annual convention of the Electric Vehicle Association, which will be held in Philadelphia, October 19, 20 and 21. Heretofore, Electric Vehicle Association conventions have been confined to two days, and it now seems that difficulty will be experienced in crowding the work into even three days.

Southwestern Convention.

The tenth annual convention of the Southwestern Electrical & Gas Association will be held at the Hotel Galvez, Galveston, Tex., on May 20 to 23. A number of general sessions, at which will be discussed matters of interest to all of the various utilities represented in the Association, will be held. There have also been arranged several separate sessions for gas, street and interurban, and electric-light and power interests; these latter sessions have been arranged so as not to interfere with each other, so that it will be possible for members to attend all of them if they so desire.

The tentative program arranged for the main sessions of the convention will contain relatively few formal or highly technical papers with the object of presenting fewer subjects, but these of greater importance, so as to leave time for ample discussion. Among the more important features on the program are a symposium on the "Safety-First" movement, in which will participate a claim agent, a superintendent of transportation, a master mechanic, a manager of electric-light and power plants, a gas superintendent, and possibly one or two other gentlemen. A paper dealing with "Fire Prevention versus Fire Protection" will be presented by the general manager of a combined railway, light, gas and water plant. A paper on "Public Policy of Public Corporations," will be presented by the general superintendent of a corporation controlling over 20 utility plants in the Southwest. A paper will be presented by the general manager of one of the largest light and power properties in Texas which will deal with the practical side of new-business work. A symposium on rates will be presented by a number of prominent gas and electric men who have made a special study of the subject. A superintendent of a railway system will present a paper on "Economy in the Use of Power in the Operation of Electric Cars."

A number of entertainment features for the ladies attending the convention, as well as for the active members of the Association, have been arranged for. The secretary of the Association is H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Society for Electrical Development Makes Changes in Publicity Department.

The Society for Electrical Development has engaged H. C. Spaulding to take charge of its news and advertising department. Mr. Spaulding is a graduate of the Massachusetts Institute of Technology, a member of the Technical Publicity Association, was formerly manager of the Thompson-Houston Company, afterwards manager of the electrical department of the Blake & Knowles Pump Company, and New England manager of Siemens & Halske Electric Company, assistant sales manager of the Triumph Electric Company and district manager of the Yale & Towne Manufacturing Company. Mr. Spaulding has had wide experience in publicity work and has been a frequent contributor to the technical papers. H. C. Plummer has been engaged by the society to assist Mr. Spaulding in his department. Mr. Plummer has had several years' training in active newspaper work and has been a writer on engineering and technical subjects for technical papers, popular magazines and daily newspapers. He has made a specialty of presenting in popular form subjects of an academic character. With Messrs. Spaulding and Plummer in charge of this department, the Society for Electrical Development is fitted for doing high-class publicity work.

Electric Club of Chicago.

At the meeting of the Electric Club held in the Hotel Sherman, Chicago, on May 7, Dr. G. Frank Lydston, professor of surgery at the University of Illinois, spoke on "The Social Awakening." He touched on a wide range of social disorders, particularly crime. In this country about half a billion dollars is spent annually in the apprehending, prosecuting and punishing of criminals. Despite our civilization, crime is not appreciably diminishing. Our attempts to cure it by punishment are futile. Crime is a social disease of degenerate or otherwise abnormal persons. The best way to handle it is to prevent it. Among the preventive measures Dr. Lydston advocated are sterilization of diseased, defective and criminal persons to check propagation of a degenerate posterity; improved standard of living through the selfish realization by employers that increased wages and better conditions of employment make for increased efficiency and productiveness of their employees; study of the psychopathic history of criminals; segregation of minor offenders from hardened criminals, etc.

Dr. Lydston has consented to speak to the club again, touching on other aspects of the problem.

Newcomb Carlton.

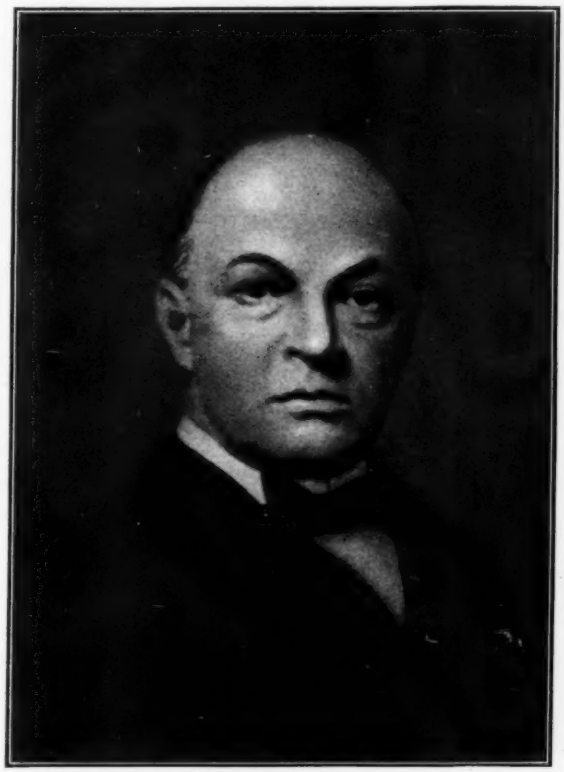
Newcomb Carlton, the newly elected president of the Western Union Telegraph Company, although a comparatively young man, has had a varied and interesting career in electrical work. A graduate of Stevens Institute of Technology, Mr. Carlton was active as a mechanical engineer in Buffalo, N. Y., until 1899, when he became director of the Pan-American Exposition in that city. When the Exposition closed he accepted the vice-presidency of the Bell Telephone Company of Buffalo for two years. In 1904 he accepted the vice-presidency of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, and in 1906 he took charge of the British Westinghouse Electric & Manufacturing Company, of London, as vice-president and managing director, remaining in London until 1910.

Upon the request of Theodore N. Vail, he became the executive head of the Western Union Telegraph Company, as vice-president and director; and upon Mr. Vail's retirement, was the unanimous choice of the directory of the Western Union Telegraph Company for the presidency of that organization. Mr. Carlton has distinguished himself by his capacity for large-organization work and quick executive decision. His work for the Western Union has already been of great advantage to that company, and his choice as president is in every way an admirable one.

Mr. Carlton is a great admirer of Mr. Vail, the former president of the Western Union, and president of the American Telephone and Telegraph Company. In a recent interview Mr. Carlton said:

"In my opinion Mr. Vail's was the most remarkably constructive mind that has been brought to bear on the affairs of any public utilities corporation. The policies of the company are outlined by the board of directors, but Mr. Vail made suggestions which have been accepted as policies of the company and which, in my opinion, will stand for a generation. Of course, there may be modifications, as exigencies require, but in my opinion the broad lines drawn by him will remain until the present officers of the company are dead."

Mr. Carlton's one diversion is yachting. He is a member of the New York Yacht Club and also of the Century Club, of New York City. He is a native of New Jersey, having been born at Elizabeth in that state in 1869.



Newcomb Carlton,
President of the Western Union Telegraph Company.

Electric Wave Investigation During Eclipse of the Sun.

An investigation of the effect on the propagation of electric waves of the total eclipse of the sun on August 21 next is to be conducted by the special Radiotelegraphic Committee of the British Association for the Advancement of Science. It is considered that the forthcoming eclipse affords an exceptional opportunity of adding to existing knowledge of the propagation of electric waves through air in sunlight and in darkness, and across the boundaries of illuminated and unilluminated regions. The eclipse will be total along a strip extending from Greenland across Norway, Sweden, Russia and Persia to the mouths of the Indus.

Two main points calling for investigation will be: first, the propagation of signal-bearing waves through air in the umbra and penumbra will probably obey laws different as regards absorption and refraction from those obeyed in illuminated air; second, the strength, frequency and character of natural electric waves and of atmospheric discharges may vary. The variations may occur either because the propagation of natural waves from distant sources is facilitated or impeded by the eclipse, or, possibly, because the production of natural electric waves or atmospheric discharges is for some unknown reason affected by the eclipse.

The committee says that to investigate the propagation of signals across the umbra it will be necessary to arrange for wireless telegraph stations on either side of the central line of the eclipse to transmit signals at intervals while the umbra passes between them. This transit of the umbra occupies about two minutes so it is desirable for Scandinavian and Russian stations to transmit frequently throughout several minutes before, during, and after totality. But stations other than those in proximity to the central line are asked to keep a complete record of the variation of signals during the eclipse. Ships in the Atlantic and fixed stations in Eastern Canada and the United States will probably be affected by the penumbra in the early morning. It is stated that the investigation of strays is of as great interest as that of signals, and the greatest changes produced in strays by the eclipse will probably be experienced at stations in Scandinavia and Russia, to reach which the waves must cross the path of the umbra.

The Radiotelegraphic Committee (whose secretary is Doctor W. Eccles, University College, London), proposes to circulate special forms for the collection of statistics of signals and strays, also a simple program of work for the authorities controlling stations near the central line.

Use of Electricity in Fighting Cancer.

The New York Skin and Cancer Hospital, New York City, has issued a statement describing the treatment of cancer by electricity and announcing the success of such treatment, not only in the alleviation of pain but also as an aid to the restoration of health.

Three methods of treatment are mentioned. These are known as fulguration, thermoradiotherapathy and electrocoagulation. These indicate, respectively, a starvation, a heating and a cooking of the cancer cells.

Convention of National District Heating Association.

The sixth annual convention of the National District Heating Association will be held at the Seneca Hotel, Rochester, N. Y., May 26, 27 and 28. Among the papers to be presented are the following: "Use of Bleeder Turbines in Connection with Steam Heating," by R. D. De Wolfe, Rochester, N. Y.; "Manufacture of Welded Iron and Steel Pipe," illustrated by moving pictures; "Hot Water Heating Under Forced Circulation," by Thomas Donahue, Lafayette, Ind.; "Expense of Operating Centrifugal Pumps Versus Double Acting Pumps," by A. C. Rogers, Toledo, O.; "Some Effects of Utility Regulation as Affecting District Heating," by D. L. Gaskill, Greenville, O., and H. Almert, Chicago, Ill.; "Effects of Superheated Steam on Heating Systems," by Davis S. Boyden, Boston, Mass.; "District Heating for Small Towns and Cities of 10,000 Population and Under," by L. T. Mason, Hornell, N. Y.; "Heat Losses from Buildings of Latest Construction," by H. Byers Holbrooks, New York City; "Preferred Practice in Heating Building," by E. L. Wilder, Rochester, N. Y.; "Advantages of Central Station Heating Over Individual Plants," by N. M. Argabrite, Elwood, Ind.; "Customers' Steam Heating Systems," by H. R. Wetherell, Peoria, Ill.; "Commercial Steam Heating in New York City," by George W. Martin, New York City. President S. Morgan Bushnell, of Chicago, is also scheduled for an address. A. D. Spencer, Detroit, Mich., will report for the meter committee; A. P. Biggs, Detroit, Mich., for the record committee; D. S. Boyden, Boston, for the educational committee, and Byron T. Gifford, Grand Rapids, for the station operating committee. Mr. D. L. Gaskill, Greenville, O., is the secretary-treasurer.

On May 29, the entire convention will go to Niagara Falls on a special Pullman train, as the guests of the American District Steam Company, of Tonawanda, N. Y. A stop will be made at Lockport, N. Y., for the purpose of visiting the first district heating plant installed. Luncheon will be taken at the Tonawanda works of the company and the afternoon spent in sight seeing at Niagara Falls. This will be followed by a dinner at the Clifton Hotel, the convention returning to Rochester in the evening.

Annual Meeting of the American Institute.

The 295th meeting of the American Institute of Electrical Engineers will be held in New York City on the evening of May 19. The Board of Directors will present its annual report and the result of the election of officers will be announced.

Following the annual business meeting, a technical session will be conducted by the Committee on the Use of Electricity in Marine Work. Two papers will be presented: "The Future of Electric Heating and Cooking in Marine Service," by H. J. Mauger; "Electricity the Future Power for Steering Vessels," by H. L. Hibbard. The usual smoker will follow.

Institute Meeting at Pittsfield.

The 296th meeting of the American Institute of Electrical Engineers will be held in Pittsfield, Mass., on May 28 and 29, under the auspices of the Pittsfield Section. Headquarters will be at the Maplewood Hotel.

The general subject for discussion is to be "Relative Advantages of Star and Delta Connections." Sessions will be held on Thursday afternoon, Friday morning and Friday evening, at which the following papers will be presented: "Experience with Line Transformers," by D. W. Roper; "Experience of the Pacific Gas and Electric Company with the Grounded Neutral," by J. P. Jollyman, P. M. Downing and F. G. Baum; "Influence of Transformer Connections on Operation," by Louis F. Blume; "A Study of Some Three-Phase Systems," by Charles Fortescue; "Harmonic Voltages and Currents in Star and Delta-Connected Transformers," by R. C. Clinker; "Relative Merits of Star and Delta Connection for Alternators," by T. S. Eden.

On Thursday evening members of the Institute are invited to participate in the annual dinner of the Berkshire County University Club. Friday afternoon will be devoted to recreation, and arrangements will be made for golf, boating, tennis and other sports.

Program of Michigan Section Convention.

As previously announced, the Michigan Section of the National Electric Light Association will hold its convention this year aboard ship en route to the Thousand Islands of the St. Lawrence River. The start will be made from Detroit on the evening of June 17, arriving in Buffalo the morning of June 18, where another steamer will be boarded for Ogdensburg, returning to Toronto on June 20. A special train will be run over the Canadian Pacific from Toronto to Detroit, arriving at the latter destination about 2:30 p. m.

The complete program has not yet been decided upon, but announcement has been made of several important papers and addresses which are assured. These include a paper entitled "Relation of Public Utilities and Returns Allowed Thereunder," by Halford Erickson, of the Railroad Commission of Wisconsin; an address by James V. Oxtoby, of Detroit; a paper entitled "Water Power in Michigan," by G. W. Bissell, of the Michigan Agricultural College; a paper entitled "The Gas-Filled Lamp," by J. R. Colville, of the National Lamp Works; a paper, the subject to be announced later, by William J. Norton, of Chicago; a paper entitled "Interior Illumination," by M. Luckiesh, of the National Lamp Works; a paper entitled "Outdoor Substations," by A. Meyer, of the Edison Illuminating Company, of Detroit; a paper entitled "Description of an Automatic Substation," by James W. Bishop, of the Edison Illuminating Company, of Detroit; and a paper entitled "Depreciation and Obsolescence," by H. A. Fee, of Adrian, Mich. Requests for papers of the same high standard as above have been sent out to some 20 members of the Association, so that it is confidently expected that a full program of interesting subjects will be provided.

It is also announced that a rejuvenation of the Jovian Order will be held on shipboard on one of the nights, this being an innovation in rejuvenations. President H. C. Sterling, of the Michigan Section, has recently been appointed statesman for Michigan, and will conduct the ceremonies.

Philip P. Barton, vice-president and general manager of the Niagara Falls Power Company, has invited the Association to inspect the plants of his company on both the American and Canadian sides during the visit at this point.

Herbert Silvester, 18 Washington Boulevard, Detroit, Mich., is secretary of the Section, and all reservations should be made directly to him prior to June 1.

Proposed Federal Tax on Power Developed on Government Sites.

An annual federal tax of 25 cents per horsepower on all power developed by hydroelectrical corporations on government water-power sites, was recently urged as an amendment to the water-power bill now before congress by M. O. Leighton, an engineer formerly with the Reclamation Service. Mr. Leighton appeared before a House committee and told the congressmen that such a provision should be provided for in the bill and not left to the Secretary of Interior as at present.

Cleveland Municipal Plant Begins Operations.

The new municipal electric light plant of Cleveland, O., was put into operation on May 2. The plant has cost the city about $900,000. It has about 5,000 customers connected to its lines. The maximum rate charged is three cents per kilowatt-hour and the minimum one cent per kilowatt-hour.

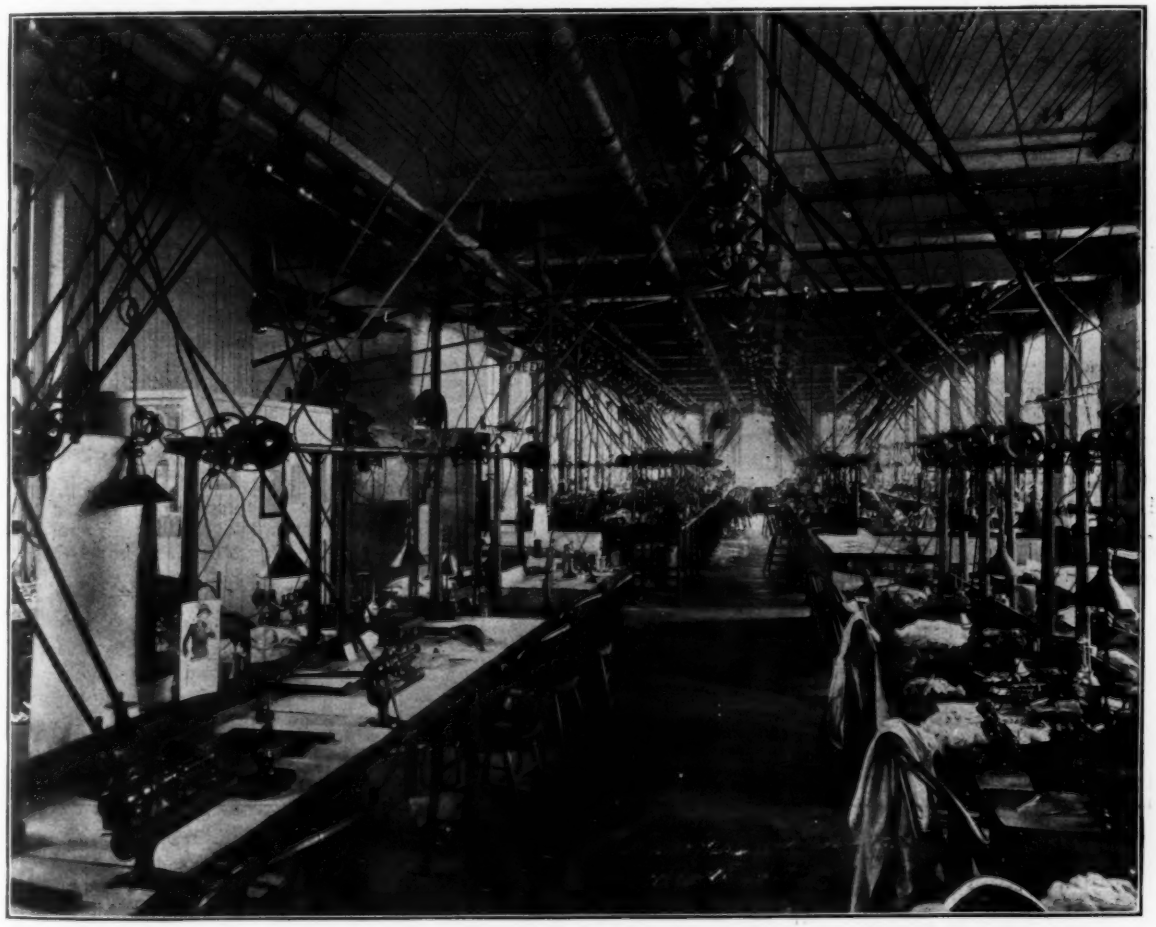
Electricity in Watchmaking.

Because of the extreme accuracy demanded in watchmaking the use of electric drive has become almost universal, due to the uniform speed possible and the ease with which the various machines can be controlled. This article discusses some of the more important advantages of electric drive, giving figures on the cost of replacing an isolated-plant equipment in a typical case with central-station service. Data on the motor installation in two other factories are included in the data sheet.

The extreme accuracy necessary in the manufacture of watches and clocks makes the question of power supply of decided importance, as accuracy depends to some extent upon uniform speed of the driven machines. The tendency in the older establishments in this industry was to drive by means of line shafting from a main engine, and sometimes when energy was purchased from one large motor. It was argued, in connection with the latter, that inasmuch as individual motor drive was out of the question the most economical arrangement was to connect all machines to line and countershafting and drive from one unit.

This practice is fast disappearing, however, and the well equipped plant will be found with a motor for each of the various departments with individual drive on a few of the heavier machines. This not only improves the quality of the product and increases the output but where power is purchased from a central station effects considerable savings in the power bill as it is seldom that all departments of a factory are in operation at the same time during the entire year and with the group drive referred to only that power which is actually used in producing is paid for. This arrangement also permits of overtime operation of isolated departments without affecting any other portion of the plant and with power costs proportional to the actual work done.

One of the most important phases influencing the successful conduct of any manufacturing establishment is the amount of output obtainable with a given personnel, tool equipment, floor space and working time. Without increasing any of these factors, the substitution of mechanical drive by the installation of electric motors has variously augmented the productive capacity of different factories from 5 to 100 per cent. In other words, a greater amount of work is produced per operative machine per day, due to maintenance of speed under varying conditions of load; the ease with which the maximum cutting speed can be sustained throughout a given operation; the advantage gained by better arrangement of machines in regard to natural or artificial lighting facilities, as well as in the readier access to and sequence of material from the unfin-



Motor Drive in Train Department of Hamilton Watch Works, Lancaster, Pa.

ished to the finished state; finally, because the greater cleanliness, purer air and generally better hygienic surroundings of the motor-driven shop re-act favorably upon the health, cheerfulness and activity of the operatives.

While increased production is obviously the most important result attained by the installation of electric drive, it is also true that direct economies are very frequently effected in the power costs. This was the case in a small clock factory in the Middle West, which, previous to the adoption of central-station service, operated a 50-horsepower isolated steam plant. After several unsuccessful attempts the central-station management obtained permission to make a detailed engineering investigation of the isolated-plant operating conditions and the results indicated that a substantial saving in power costs could be effected by the installation of electric motors and the use of central-station power.

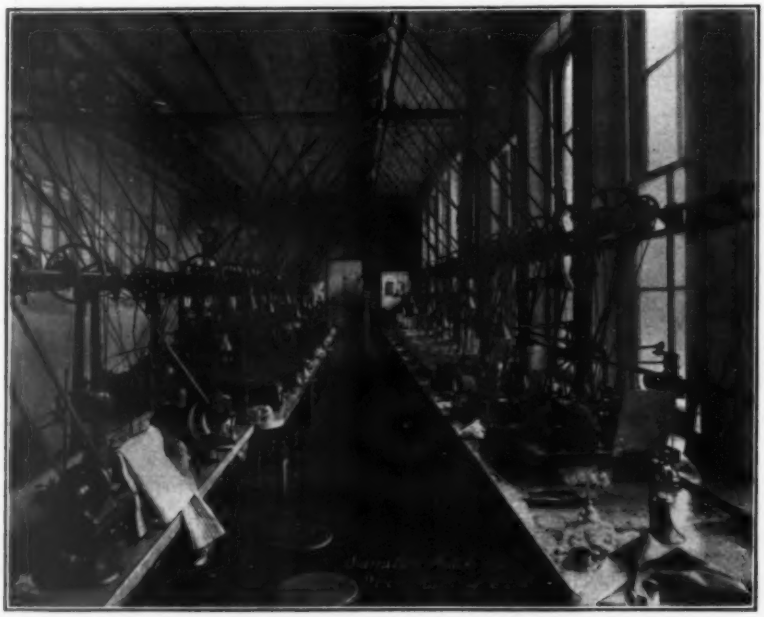
The original equipment of this factory comprised a 50-horsepower slide-valve engine supplied with steam from a 90-horsepower horizontal return-tubular boiler. No traps were used in the steam piping which supplied various parts of the factory with heat. As is true of many plants operating under these conditions, considerable annoyance was experienced, especially in the winter, at the slowing down of some of the machines, polishing apparatus and steam-driven blower equipment, production being greatly diminished under mechanical driving. Since the installation of electric motors the production in these departments has been increased 13 per cent and in addition the uniform speed of the motor-driven machines has greatly improved the quality of the work.

Two Five-Horsepower Motors Driving Machines in Jeweling Department, Hamilton Plant.

Squirrel-cage induction motors, aggregating 32.75 horsepower, operating at 220 volts, three-phase, 60 cycles, were installed throughout, as follows:

One three-horsepower motor, 1,200 revolutions per minute, driving scratch-brushing and coloring equipment, including two direct-current plating dynamos; three scratch-brushing heads, and one 13-inch exhaust fan.

One 7.5-horsepower motor, 1,200 revolutions per minute, driving automatic screw machines, wheel-cutting machines, etc.



Motor Driving Two Lines of Screw-Making Machines, Hamilton Plant.

One two-horsepower motor, 1,200 revolutions per minute, driving a duplex power pump located in the engine room.

One 7.5-horsepower motor, 1,200 revolutions per minute, driving a line shaft which operates machinery in train and balance departments.

One 0.5-horsepower motor, 1,800 revolutions per minute, belted to a line shaft driving two high-speed drills, and three small lathes.

One 0.25-horsepower motor, 1,200 revolutions per minute, driving a tub-cleaning machine.

One one-horsepower motor, 1,800 revolutions per minute, driving a double emery wheel, 10 inches in diameter.

One five-horsepower motor, 1,200 revolutions per minute, belted to a line shaft driving two drop hammers, 450 pounds and 300 pounds; two 200-pound and two 75-pound drop hammers; one power press, and one rotary shear.

One two-horsepower motor, 1,800 revolutions per minute, driving a machine-shop equipment comprising two engine lathes; one shaper; one emery wheel; one cut-off saw; one grindstone, and one milling machine.

One two-horsepower motor, 1,800 revolutions per minute, belted to a line shaft driving four power presses and 16 small bench lathes.

One two-horsepower motor, 1,800 revolutions per minute, driving a No. 3 American gas-furnace blower.

The estimated cost of electric energy for this factory was $66 per month, based upon a 10-hour day and service used 300 days per year. The average monthly consumption of energy was 2,200 kilowatt-hours, the average rate being three cents per kilowatt-hour. In

Two Five-Horsepower Motors Driving Machines in Escapement Department.

soliciting the business of this factory, the fact that central-station power would be available at all times was emphasized; also it was pointed out that a licensed engineer or fireman would not be needed so long as the steam pressure was kept below 15 pounds per square inch, since steam was not to be used for developing mechanical power. In this case is was simply necessary to equip the boiler with a sealed safety valve set at 15 pounds per square inch to eliminate the services of an employee receiving $150 per month.

The total cost of operation, as estimated by the central-station company, excluding fixed charges, was $1,444.50, the items being as follows: electric energy, $792; coal for heating, 59 tons at $4.50, $265.50; coal for commercial uses, $207; attendance, one quarter of the time of one man at $60 per month, inspecting motors, firing boiler, etc., $180; total, $1,444.50. As a matter of fact, this estimate was high, the cost of operation averaging less than $1,444.50. The management of the factory is highly pleased with the economies being effected and with the numerous advantages of electric drive that have been realized in this instance.

The total cost of equipping the factory for motor drive was only $920, divided as follows: motors, complete, $668; wiring, fittings, switches, etc., $160; pulleys, belting, shafting, hangers, etc., $80; drying boxes connected to vats, piping and labor, $12; total, $920.

In this factory, as in many others where isolated plants are to be converted, the question of heating was an important factor. The heating hours were as follows: January, 419; February, 378; March, 334; April, 279; May, 170; September, 170; October, 287; November, 323, and December, 419, making a total of 2,779. The condensing factor of radiation was taken as 0.35 or 0.35 pound of steam per hour for every 100 square feet of radiation, giving a total of about 385 pounds of steam condensed per hour. On this basis it was found that about 59 long tons of coal were required for the heating season of nine months.

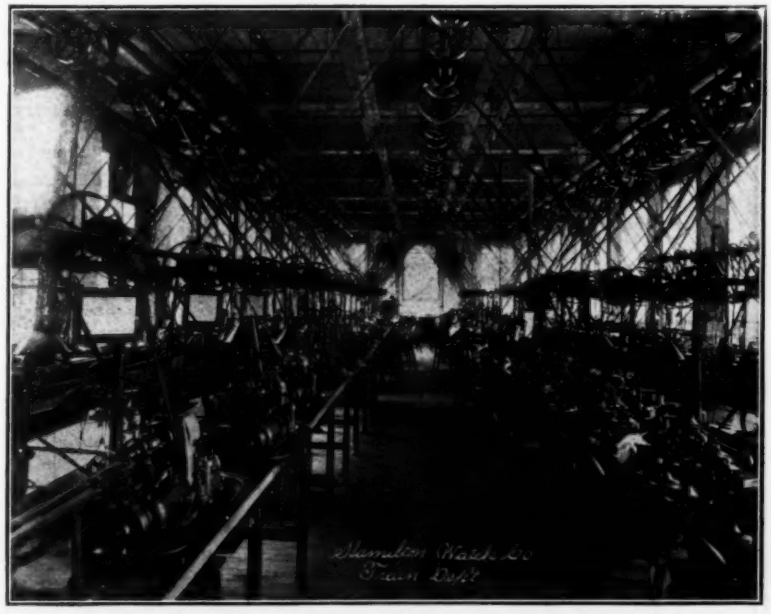
Considerable steam is also required for commercial purposes, the requirements for the entire plant being summarized as follows:

Coloring room	347,400 pounds.
Vat in sink	6,192 pounds.
Steam acid blower	206,400 pounds.
Pickling vat (first floor)	86,850 pounds.
Vats in sinks (first floor)	86,850 pounds.
Sinks (second floor)	86,850 pounds.
Total	820,542 pounds.

On the basis of an evaporation of eight pounds of water per pound of coal, there would be required for this work a yearly fuel consumption of 102,567 pounds of coal, or 46 tons of 2,240 pounds each.

In soliciting the adoption of central-station service by watch and clock factories emphasis should be placed on the possibility of securing greater accuracy because of the uniformity of the speed of motor-driven machines and the ease with which these machines can be controlled. No specific recommendations can be made regarding the application of motors to watch making machines or the approximate horsepower requirements of these machines as every plant differs materially in the work performed and the type of machines used.

In general, however, it may be stated that the requirements of the individual machines are so small that there is practically no limit to the number that can be driven by an average-size motor. The operations in watch and clock making are classified into several distinct departments which are entirely independent of each other. It has, therefore, become common practice to at least provide a separate motor for each department. This arrangement, while capable of improvement, at least allows each department to operate without reference to the others, which is



Motor Drive in Train Department, Hamilton Watch Company.

Watch Manufacturing Data.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Plant manufacturing a high grade of watches. Plant operates 9 hours per day.

Total connected horsepower, 93. Total number of motors installed, 17. Average kilowatt-hours per month, 12,308.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	11,450	May	5,040	September	16,070
February	17,120	June	5,040	October	17,530
March	16,600	July	6,030	November	17,200
April	4,040	August	15,900	December	11,450

Load-factor, 24.3; operating-time load-factor, 56.5 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	850	Belted direct to blower.
1	3	1,120	Belted to line shafting driving one plating dynamo; 15 brushing machines; and stoning plates.
1	5	850	Belted to line shafting driving 12 buffing machines; 12 damaskeaming machines; and four small emery wheels.
1	5	850	Belted to line shafting driving 15 damaskeaming machines.
1	10	850	Belted to line shafting driving wheel-cutting machines; stamp lathes; pinion-cutting machines; and bench lathes.
1	3	1,120	Belted to line shafting in the dial department driving drilling and grinding machines. There are four electric furnaces installed in this department.
1	7.5	850	Belted to line shafting driving 30 automatic screw machines. These machines are each equipped with electric signal lamps indicating when more stock is needed.
4	3	1,120	Each belted to line shafting driving variety of small cutters, grinders, etc., in jeweling department.
2	5	850	Each belted to line shafting driving machine in balance department, including bench lathes; pinion cutters; grinders, etc.
1	7.5	850	Belted to line shafting driving machines in plate department.
2	7.5	850	Each belted to line shafting driving 18 bench lathes; 8 engine lathes; small drills; milling machines; saws; etc.
1	10	850	Belted to line shafting driving machine-shop equipment comprising nine Blake punch presses; one drop hammer; one engine lathe: two shapers; and two drills.

Small watch and clock factory operating 10 hours per day.

Total connected horsepower, 32.75. Total number of motors installed, 11. Average kilowatt-hours per month, 2,200.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	2,400	May	1,900	September	2,460
February	1,600	June	1,670	October	2,560
March	1,410	July	2,310	November	2,650
April	1,600	August	2,390	December	2,540

Load-factor, 12 per cent; operating-time load-factor, 25.8 per cent.

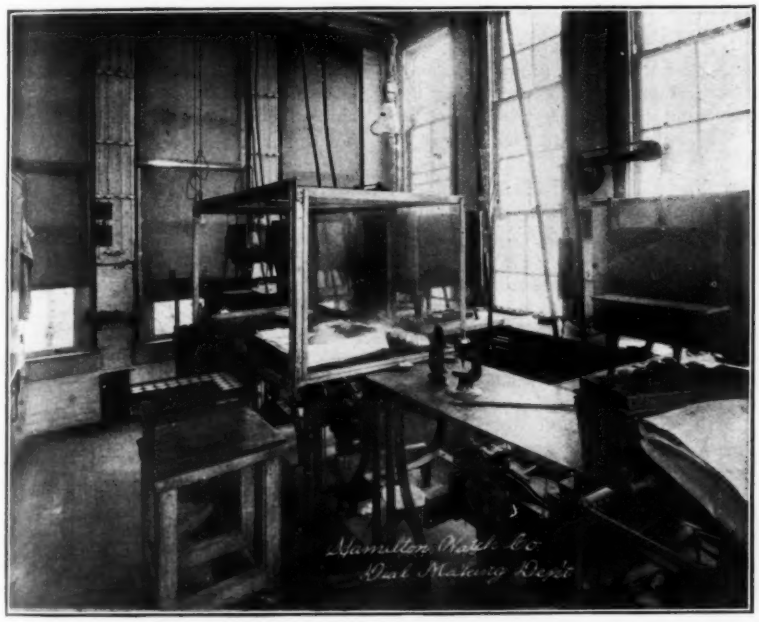
MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Squirrel-cage motors are used.

No.	Horse-power	Speed R. P. M.	Application.
1	2	1,800	Belted direct to a line No. 3 American gas-furnace blower.
1	2	1,800	Belted to a line shaft driving four power presses; and six high-speed lathes.
1	2	1,800	Belted to line shafting driving two engine lathes; one shaper; one emery wheel; one cut-off saw; one grindstone; and one milling machine.
1	5	1,200	Belted to a line shaft driving two drop hammers, 450 pound and 300 pound; two 200-pound hammers; one 75-pound hammer; one power press; and one rotary shear.
1	1	1,800	Belted direct to one 10-inch double emery wheel.
1	0.25	1,200	Belted direct to one tub-cleaning machine.
1	0.5	1,800	Belted direct to a line shaft driving two high-speed drills; and three jeweler's lathes.
1	7.5	1,200	Belted to a line shaft driving jeweling machines; grinders; and brushers.
1	2	1,200	Direct-connected to duplex pump.
1	3	1,200	Belted to line shaft driving two direct-current plating dynamos; three scratch-brushing heads; and one 13-inch exhaust fan.
1	7.5	1,200	Belted to line shafting driving 18 bench lathes; 18 pinion cutters; 20 automatic screw machines; 8 stamp lathes; and 12 wheel-cutting machines.

particularly economical during dull seasons or when overtime work is necessary.

The machines used in manufacturing watches and clocks occupy such small space and need such good illumination that the usual practice is to arrange the machines in long lines along the windows; in two or more lines if the lighting facilities permit. In such cases two methods of drive are commonly employed. One method is to attach a motor to each of such lines; another method is to divide the lines in the center, if two are installed, using extended-shaft motors and connecting by belt to both shafts. The latter method permits of obtaining better alinement of the shafts than when one long shaft is employed. Local conditions, of course, govern the method to use.



Electric Furnaces at Hamilton Plant.

The accompanying illustrations of motor drive in the factory of the Hamilton Watch Company, at Lancaster, Pa., are typical of plants in this industry. In several of the departments of this establishment four lines of machines are located in a room. These are driven by two motors, installed on platforms, belted first to the shaft farthest from the motor then from this shaft to the one nearest the motor. In departments where only two lines of machinery are installed, extended-shaft motors are used, each motor driving one-half of both shafts.

The equipment in the Hamilton plant, described more fully in the accompanying data sheet, includes four electric furnaces which have proven particularly suited for this class of work. Two are used for tempering and two for hardening and the company states that their operation is thoroughly satisfactory in every way. The working conditions in the hot weather in this department are greatly improved and the cost of operation compares very favorably with the gas furnaces which they displaced.

Lighting.

The difficulty experienced in attempting to outline any specific requirements for lighting is due chiefly to the diversity of work performed. Allowing somewhat for the difficulty thus encountered, these requirements, in a general way, are as follows:

Workmen should be able to perform their duties and more around, not only with comparative ease, but with small accident risk as far as it depends on artificial illumination. In many cases this result may be obtained by the use of a low degree of general illumination. It may be here recorded, however, that in general a higher degree of artificial illumination is warranted in most of the buildings than has been the case in the past, or than will possibly be admitted in the near future as economical. This refers to a sufficient intensity to permit the performance of work at any portion of the floor space without respect to location of the lamps. Obviously, this can be obtained to the best advantage by means of the so-called overhead method of lighting.

Where there is a choice between low and high mounting the lamps should in general be mounted at the higher point in order to avoid the blinding effect, which has of late been given the name of "glare," not only produces eye strain, but reduces the effectiveness of the artificial light, because a man can never see to the best advantage when his vision is intercepted by the bright rays of light from a lamp approximately in the line of vision.

Lighting and motor circuits should be kept entirely separate. This will ordinarily insure reliable illumination, and the operation of the lamps is thus made far superior to those cases where the attempt is made to operate both lamps and motors from the same circuits.

From the nature of the case, numerous instances will be found where the artificial illumination must be sufficient without the use of individual hand lamps. This is due to the nature of the work, which makes impracticable the handling of incandescent lamps by the workmen, but without sufficient light from overhead lamps it is impossible to realize the best results. Thus, in the average case it may be an actual handicap for the workmen to be encumbered with extension lines in the performance of their work. It is imperative, therefore, if the conditions are to be such as to promote the highest standard of efficiency under the conditions of natural darkness, that light be furnished from lamps mounted overhead and sufficiently out of the line of vision.

From the engineering standpoint, the kind and size of the lamp should be consistent with the mounting height and also with the class of work under consideration. That is, for high ceilings large lamps should be used, while for low ceilings lamps of relatively small candlepower should, in most cases, be employed.

Cheap Gas Stimulates Electricity Sales in Louisville.

The commercial department of the Louisville (Ky.) Gas & Electric Company, of which Robert Montgomery is manager, is meeting with success in its dual proposition of natural gas for heating and electricity for light and power. Natural gas at 35 cents a thousand to heat a small boiler, sufficient to run the steam heating plant in a building, and current bought of the company, it has been shown, will cost less than a great many Louisville concerns are paying now for the generation with steam power of their own electricity, the boilers being utilized in the heating of the building. Such service is being supplied by the company now to a number of local concerns and Mr. Montgomery is negotiating, with every prospect of success, for such installations at the Y. M. C. A. Building, the City Hall, the Atherton Office Building, the Willard Hotel and some half dozen other enterprises of like character.

Commercial Practice
Management, Rates, New Business

Special Meeting of the Ohio Electric Light Association.

As a result of an order issued by the Public Utility Commission of Ohio requiring all utilities of the state to submit an inventory and appraisal to that body by August 1, 1914, a special meeting of the Ohio Electric Light Association was held at Columbus, O., May 6, to which representatives of all utilities of the State were invited. The Executive Committee of the Association met on the day preceding the meeting and prepared a set of resolutions dealing with questions of policy involved in obeying the order of the Commission, which were presented at the session on Wednesday. The meeting was held at the Chittenden Hotel, with representatives from 65 central stations in attendance.

J. C. Martin, president of the Association, called the meeting to order at 10 a. m., and presented to the delegates the reasons for issuing a call for a special meeting. He stated that the order of the Commission is probably the most important one that has yet been issued and in order that it may be complied with in the proper manner it is necessary, he said, that the utilities of Ohio have definite information and some understanding of what is desired. He explained that the Commission is more particular as to the inventory than it is to the valuation to be placed thereon ,and it is the intention of the Commission that his inventory as filed be kept up from time to time by supplementary reports to be made by the utilities and to be a basis which can be resorted to by the Commission in determining just and reasonable rates when occasion arises.

It was stated that the attitude of the Commission toward the utilities is very cordial and all time necessary will be given to file the schedules required.

The report of the Executive Committee, which was presented by Secretary Gaskill, provides for the appointment of an Accounting Committee which also was requested by the Commission, and also an Appraisal Committee, the latter to act as consulting engineers, to advise and consult with all utilities of the state regarding the filing of inventories and appraisals and to review all schedules before they are presented to the Commission so that uniformity will be obtained. This committee will also prepare and supply to the utilities of the state forms to be used in making inventories and appraisals, and in this connection is empowered to employ such expert advice and assistance from outside as may be necessary. To defray the necessary expenses of these committees a special assessment of one-twentieth of one per cent of the annual gross income of the companies participating was proposed. The delegates assembled unanimously approved of the recommendations proposed and as a result committees were appointed as follows: Appraisal Committee: F. M. Tait, of Dayton; F. W. Milliken, of New York; Robert Lindsay, of Cleveland; F. J. Derge, of Toledo; and W. W. Freeman, of Cincinnati. The Accounting Committee appointed comprises L. K. Funkhouser, of Dayton; J. Scobel, of Cleveland; M. Kalisch, of Cincinnati; R. Stevens, of Youngstown, and F. W. Dreger, of New York. Permanent quarters will be obtained in a local office building.

In the discussion preceding the adoption of the resolutions proposed by the Executive Committee, F. W. Milliken, of the American Gas & Electric Company, New York, called attention to the importance of including intangible items in arriving at a fair valuation of a property. Such costs as contractors' profits, liability insurance during construction, etc., are too often lost sight of when preparing an estimate of the value of a property, but are equally as important as the "bare bones" cost.

President Martin stated that there is some hesitancy on the part of utility companies including all intangible items in making valuations, because of their fear that these valuations will be used by the Tax Commission in assessing taxes. He stated that this practice should be discouraged, as only one valuation can be honest and equitable, whether made for the Tax Commission, Public Utility Commission or for any other purpose. In the end, rates will be earned on the total valuation.

Judge W. P. Matthews, of Dayton, called attention to another evil in making different valuations for different purposes. He stated that from the legal standpoint, after having made a low valuation for the Tax Commission, it would be impossible to increase this if it was desired to issue securities. He emphasized the point made by Mr. Martin that only one valuation can be correct.

Following the discussion on the Commission's order, Secretary Gaskill was called upon to give some details regarding the forthcoming annual convention of the Ohio Association. He stated that a departure will be taken from the practice of previous years of holding sessions only in the morning. There will also be fewer technical papers and more addresses by prominent speakers. Among those already accepting invitations to address the Association are Halford Erickson, of the Wisconsin Public Service Commission, who will speak on indeterminate franchises, and F. W. Darlington, of the Iron and Steel Institute, who will talk on welfare work. Mr. Gaskill also called attention to the *Monthly* issued by the Association, which at the time of the convention in July will have written advertising contracts in excess of $5,000. He asked for the co-operation of the members in making the publication useful, editorially.

Double Taxation of Utility Income Opposed.

The Cincinnati Gas & Electric Company has filed suit in the Federal Court at Cincinnati, O., against the collector of internal revenue for $44,847.89 alleged to have been paid in taxes under the corporation excise tax provision of the 1910 tariff law, which the company believes should not have been paid. The ground set up for the return of the taxes is that the company's revenues are derived solely from its lease to the Union Gas & Electric Co., which pays a tax on its income, and that payment of another tax on the same income under the same law should not be required. The fact that the company is not engaged in business, save by its lessee, is another factor upon which stress is laid.

House-Wiring Campaign in New Albany, Ind.

The Insull property in New Albany and Jeffersonville, Ind., the United Gas & Electric Company, has recently begun a house-wiring campaign in a small way in those southern Indiana cities. It is meeting with pleasing success and will be pushed later in the season, it is understood.

WIRING SPECIFICATIONS AND SCHEDULE OF PRICES

LOCATION	Ceiling Outlet	Bracket Outlet	Wall Switch including Snap Switch	3-way Snap Switch (Pair)	Base Recpt. inc. Snap Recpt.	M. M. Bracket Brick Wall	M. M. Snap Swt. Brick Wall	Concealed B X Bracket Brick Wall	Concealed Flush Swt. Brick Wall	Open Work per Outlet	Snap Swt. Basement
PRICE EACH	$2.50	$2.50	$2.75	$6.00	$3.00	$3.50	$3.50	$4.50	$5.65	$1.50	$1.50
Porch,											
Vestibule,											
Reception Hall,											
Reception Room,											
Living Room,											
Library,											
Dining Room,											
Lavatory,											
Pantry,											
Kitchen,											
Basement,											
Rear Hall,											
Upper Hall,											
Upper Rr. Hall,											
Bath,											
N. E. Chamber,											
S. E. Chamber,											
N. W. Chamber,											
S. W. Chamber,											
Chamber,											
Chamber,											
Closets,											

Flush Switches and Flush Base Board Recpts. $1.00 extra each.

Four, Five or Six, Outlet Contract, at $3.00 per Outlet,

Application for Electric House Wiring.

Louisville, Ky. ....., 191....

The undersigned, ...

.....

hereby make application to.....

hereinafter called the "Contractor," for wiring the premises and installing fixtures as listed herein, at No. .....in accordance with the specifications and schedules endorsed hereon and attached hereto, which are incorporated herein, and agree to pay therefor at the office of the Contractor the sum of ..... Dollars ($.....) as follows:

Twenty-five (25%) or .....Dollars ($.....)

on completion of work and the balance in twelve (12) equal monthly payments, or.....

Dollars ($.....) on or before the first of each month following, until the whole amount has been paid. Failure to meet payments when due shall render the deferred payment feature of this contract void, and the remaining payments on said contract shall become due and payable at once.

A discount of ten per cent. (10%) from the above contract price will be allowed, provided full payment is made within **ten (10) days from the date of completion of installation.**

It is mutually agreed that in event of any modification of the installation specified herein, the amount of this contract shall be revised in accordance with the Schedule of Prices incorporated herein.

The Contractor shall wire said premises and install fixtures as herein specified with forty (40) Watt Mazda or Tungsten lamps, including all labor and material necessary to do the work, covered by the General Specifications and Schedules incorporated herein and made a part hereof, in a thoroughly substantial manner, according to the Rules and Regulations of the National Board of Fire Underwriters as interpreted by the City Electrical Inspector, complete and ready for service.

The Contractor shall save harmless the Applicants from any and all damage or expenses that may arise during the performance of this contract by reason of injury to persons or property resulting from negligence or carelessness on the part of the Contractor in the performance of this contract.

The Contractor agrees to commence work within ..... days of the acceptance of this contract and to complete same without unnecessary or unreasonable delays.

.....
Tenant.

.....
Property Owner.

} Applicants.

Accepted the.....day of....., 191.....

.....
Contractor.

Forms Used by Louisville Gas & Electric Company in House-Wiring Campaign Being Conducted.

House-Wiring Results in Louisville.

The house-wiring campaign which is being conducted by the Louisville Gas & Electric Company, and which was described fully in our issue of April 25, 1914, has to date resulted in a total of 720 contracts for the wiring of old houses. These contracts were all signed by the company's own solicitors and it is estimated that independent contractors have obtained as many more. The contracts brought in by the company's solicitors average about 70 a week.

It is estimated that there are approximately 40,000 residences in Louisville and that, of these, there are 15,000 at present connected to the company's lines. Assuming that 50 per cent of the remainder is prospective, there are approximately 12,500 old unwired houses which are considered prospective lighting customers.

It is the intention of the Louisville Gas & Electric Company to keep this campaign going for at least a year, or until practically every home is wired or connected to the company's lines should it be found that some of these houses are already wired but not connected.

The application form and schedule of prices which are being used in this campaign are shown herewith.

House Electric at Washington, D. C.

Until recently the Potomac Electric Power Company, of Washington, D. C., has equipped and maintained a display of things electrical in a private residence, along the lines adopted by the Boston and Baltimore companies, which has resulted in greatly stimulating the use of domestic appliances in the National Capitol. Recently the house, which was only temporarily leased by the company, was sold by the owner and the display removed, but the success of this venture makes it practically certain that another house will be selected.

The house just vacated was suituated at Mt. Pleasant and Hobart Streets, the end house of a row of dwellings erected by a local builder. The building was completely furnished and decorated and, in fact, was ready for occupancy.

The drawing room contained an electric luminous radiator in the fire place and an electrically operated Steinway piano besides a couple of stand lamps and the permanent lighting fixtures in the room.

In the entrance hall there was large standard which, together with the ceiling fixture, made a very bright effect.

The dining room contained an electric coffee percolator, samovar, chafing

dish, toaster and an instantaneous water heater.

The kitchen was, of course, equipped with an electric range, fireless cooker, waffle iron and a coffee percolator.

On the second floor the library was attractively lighted. The bath room contained a luminous radiator and shaving mirror; in the bed rooms were found the reading lamps and heating pads, electric curling iron and comb combination outfits and massage machines.

The third floor was used for demonstrating purposes for vacuum cleaners, sewing machine motors, portable lamps of various types and styles and other devices that can not conveniently be carried in the other parts of the house.

In the cellar there was an electric refrigeration machine, electric washing machine, electric irons, and a lamp and meter board which had been fitted up for the purpose of demonstrating to the public the comparative amounts of current required by different sizes and kinds of lamps and the operation of the electric meter. A special feature in the cellar was an electric incubator and in this connection the company had a guessing contest, under the rules of which, the three parties guessing nearest the time of the birth of the first chicken would receive electrical devices as prizes.

In the yard was a portable garage containing an electric vehicle and the necessary charging equipment both for charging electric-vehicle batteries and also for charging ignition batteries. In this garage there was also a tire pumping outfit.

The attendance at this "House Electric" was very gratifying. The average attendance for week days was about 400 to 500 and on Sundays the average attendance was approximately 1,100.

Central Station Conditions at Fulton, N. Y.

The Fulton, N. Y., Light, Heat & Power Company has 1,092 residences conected and its patrons have in use 1,093 electric flat irons. This speaks volumes for the character of the service the company is giving and the energy of its management and new-business department.

The Fulton Company has a new steam turbine plant, two units each of 625 kilovolt-amperes capacity, connected with the New York Central and the New York Ontario & Western Railroads by a private switch which permits the dumping of coal from the cars to the boilers. During the month of February, the plant consumed an average of 3.49 pounds of coal per kilowatt-hour.

Increasing Business Makes Extensions Necessary in Twin Cities.

Permanent improvements and extensions for 1914 to the Minnesota properties of the Consumers Power Company of that state, all of the stock of which is owned by Northern States Power Company, are already in progress under the engineering supervision of H. M. Byllesby & Company. Most of the materials and machinery have been ordered and the Coon Rapids hydroelectric development on the Mississippi River near Minneapolis is being completed. The first 2,100-horsepower unit of this new water power, which will add 10,500 horsepower to meet the rapidly increasing electrical demands of Minneapolis is expected to be in operation August 1.

Construction work authorized for the Minneapolis Division within the City of Minneapolis includes enlargements to substations, additions to the 13,000-volt underground systems and extensions to the distributing lines in various parts of the city. These improvements will enable the company to serve a large amount of new business which will be added by next fall and to properly distribute the output from Coon Rapids.

Another important construction will be a transmission line 33 miles long from St. Paul south to a point three miles east of Northfield, where it will connect with the hydroelectric network of the Faribault and Mankato divisions comprising 100 miles of transmission lines. This line will be of Byllesby standard construction designed to carry 60,000-volt pressure. It will roughly parallel the Chicago, Milwaukee & St. Paul Railway and proceed via Farmington, Westcott, Rosemont and Castle Rock, opening a number of additional rural markets for service. Connection of the distributing systems of the Twin Cities and the Faribault and Mankato Divisions will insure further reliability and quality of service, and will give to a considerable section of Southern Minnesota an interurban electric light and power service matched by few other communities. Five water-power plants with 36,500 installed electrical horsepower and six steam stations with 29,500, or a total of 66,000 horsepower will be connected to the system. During the present year a number of short extensions will probably be made to serve additional cities and towns.

Power contracts covering a total of 784 horsepower were secured by the Minneapolis General Electric Company during the week April 20 to 25. Of this amount 600 horsepower was with the Northern Dredge & Dock Company, which has a contract with the Park Board for dredging one of the new lakes. The power will be used about eight months of the year for 20 hours each day and the revenue to the company will be approximately $20,000. The work will require four or five years to complete.

Ornamental Lighting as a Business Booster.

Merchants on Penn Avenue between the Monongahela River wharf and Eleventh Street have adopted street illumination as a business stimulant. Heretofore this thoroughfare, although one of the main traffic arteries in the city, has been so dark that at night it has been consistently avoided. An association of the merchants took the matter up with the city, with the result that an illumination system claimed to be unequalled in Pittsburgh has been installed. In the retail district from Fourth Street to Eleventh Street 70 arc lamps, suspended from brackets on the iron trolley poles, have been placed. This gives each block ten lamps and a total candlepower of from 85,000 to 90,000. The lamps are 15.5 feet above the street level. The arms or brackets are ornamental and are a radical departure from the old types of lamp-hanging. The system used is new in Pittsburgh and has made a favorable impression on electrical engineers. The Penn Avenue merchants have shown their appreciation of the new system by installing brilliant electric displays in their show windows and by putting up electric signs.

Aggressive Central-Station Campaign in Topeka.

By way of launching an aggressive campaign to increase the use of electricity, the Topeka, Kans., Edison Company has announced a marked reduction in minimum charges. The former minimum was $1.50 a month during the winter and 75 cents in summer. This has been cut to 40 cents per month, the new rate to be effective during the entire year. In addition, the company is stimulating the use of electricity by extending an exceptionally liberal offer to local residents whose houses are not wired for electricity. Such residents may have the wiring done through any recognized contractor, the company bearing the cost and securing a refund in six equal monthly payments. The maximum amount, however, on any one job of wiring will be $75. The easy-payment plan will apply only to unwired, completed structures, and not to those in course of construction.

The Second International Congress of Consulting Engineers is to be held in Berne, Switzerland, from July 15 to 22. The first was held last year in Ghent, Belgium. It is proposed to hold the third in San Francisco in September, 1915.

Electric Show at Alliance.

The new-business department of the Alliance (O.) Gas & Power Company, under the direction of W. E. Quillin, manager, recently held an electric show that established a record in attendance and in business stimulated.

Although the population of Alliance is but 17,000 the total attendance during the show period was in excess of 20,000. This was accounted for by the fact that the show was very interesting and a great many people came back the second and third time and some were seen there every day during the show.

Household appliances and commercial illumination were featured. A great many appliances were sold during this show but the greatest results were obtained from the commercial exhibit, for, the merchants have received a new idea as to lighting up their stores; that is, the value of well-lighted windows and efficiently and well-lighted interiors.

Exhibits at Alliance Electric Show.

The commercial display consisted of a complete display of Holophane reflectors in small booths, each one showing the results obtained from the use of reflectors, and a model show window also demonstrated the value of properly placed reflectors. A view of the exhibit is shown in the accompanying illustration.

Classification of Accounts Practically Agreed on in Missouri.

A tentative agreement on a classification of accounts for members of the Missouri Electric, Gas, Street Railway and Water Works Association was reached at a meeting of the committee recently appointed, held in Kansas City on May 6 and 7. The committee conferred with J. M. McShane, statistician of the Missouri Public Utilities Commission, and rapid progress was made during the two-day session. Phillip J. Kealy, of the Kansas City Railway & Light Company, presided. The classification originally recommended by the Missouri Public Utilities Commission was taken as a basis for negotiations. Amendments were proposed as each provision was reached, and thorough harmony and satisfaction marked the sessions. Many minor changes were made, though no radical departures were recommended. The tentative agreement will be presented to the Missouri Association at its annual meeting on May 21 for its endorsement.

Los Angeles Decides on Municipal Operation.

An election was held in Los Angeles, Cal., on May 8, to decide whether the municipality should issue $6,500,000 in bonds for the purpose of acquiring and constructing a system for supplying electricity in the city.

The water supply of the city is brought down from the mountains through an aqueduct constructed in recent years by the city. It is proposed to generate current from this water at suitable points along the aqueduct, transmitting it to the city and there distributing it.

The proposition for distribution of power by the city was strongly opposed by the present utility companies, and a forcible article entitled "The Truth About the Power Bonds" was prepared by R. H. Ballard, of the Southern California Edison Company, which was distributed prior to the election. The companies maintain that it would be to the best interests of the city to supply the power in bulk to the present companies and let them utilize it over their present distribution lines.

A two-thirds' vote was necessary to authorize the bonds and the issue was carried by 56,199 to 23,179.

There are now three companies serving the city of Los Angeles. It is said that the present program of the city is to acquire one of the existing systems by condemnation.

New York Edison Ball Team Starts Practice.

The New York Edison ball team, three-time champions of the electrical industry recently held its first practice. The biggest out-of-town game will be at Philadelphia during the National Electric Light Association Convention in June. Teams from the Philadelphia Electric Company, the Baltimore Gas and Electric Company and the Commonwealth Edison Company of Chicago, representing the East, the South and West will meet in an elimination series. The team will be captained by M. Donovan, short stop. H. C. Fling is the manager and the schedule is being arranged by Albert Goldman of 362 East 149th Street, New York City.

Timeliness in Central-Station Advertising.

Eugene B. Palmer, handling the advertising of Walker Bros., bankers, of Salt Lake City, in his address May 8, before the Salt Lake Ad Club on the subject, "New Applications of Advertising" commended the Salt Lake public utilities, particularly the telephone company and the Utah Light & Railway Company, on the progressive advertising policy which they were pursuing. As an illustration of timeliness in advertising, he threw on the screen a slide of an advertisement run by the Utah Light & Railway Company the day following the attempt of the black-hand gang in Ogden to blow up the residence of David Essles by planting a dynamite bomb under the front porch. The advertisement depicted a front porch light thrown on and a suspicious looking character slinking away into the bushes to escape the light, and was headed, "Burglars and Black-handers Shun the Light." The reading matter pointed out how this attempt to destroy life and property could have been avoided by the regular burning of a porch light each night.

Electric Sign Data

New Sign Installations at Louisville.

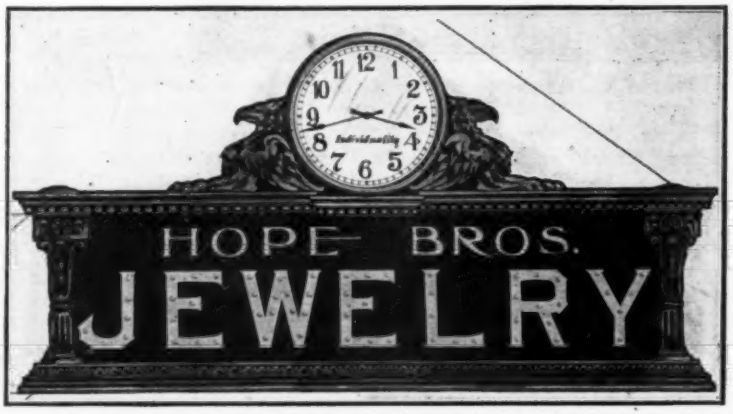
Something of a departure in the way of electric signs is that just erected in Louisville, Ky., by the Federal Sign System (Electric) for the Majestic moving picture theater. The sign, elevated, stands in an otherwise vacant corner lot at Second Street and Broadway, a large transfer point, the intersection of two largely traveled streets and a corner that many of the country cars on the interurban lines pass as they enter the city. The sign is the design of James L. Thomas, of the company, and is attracting much attention. The theater it advertises is three squares away.

The design of the sign, with outside dimensions of 20 by 25 feet, provided for the name "Majestic" in 24-inch sectional letters while below is a large bill board, 8 by 15 feet, on which there is room for ten or a dozen lithographers' sheets calling attention to the attraction at the theater. It is a straight light proposition all around and takes 150 lamps.

Mr. Thomas has received a most complimentary letter from E. M. Walbeck, manager of the Kentucky branch of the Surety Coupon Company, congratulating him and the company on a large electric sign erected at Fourth and Market Streets, in Louisville. The sign is designed in the form of the company's wreath trade mark and to carry out the copy required 500 five-watt tungsten lamps. It has been set up only since the first of May and is giving entire satisfaction to the Surety Coupon people. Another new overhead sign in Louisville is that put up on Fourth Street opposite B. F. Keith's vaudeville theater for Old Clover Sour Mash Whiskey. It uses 400 five-watt lamps, measures 10 by 15 feet, and displays the name of the whiskey, the words "Sour Mash" flashing off and on.

The Duquesne Light Company, of Pittsburgh, has begun a system of "reciprocal advertising" that is attracting wide attention among newspaper readers. The lighting company has taken merchants, who have been liberal users of electricity for advertising, and featured them in display advertising as examples of success. W. S. Brown, who is known throughout Western Pennsylvania as "The Gunman," was one of the pioneers in electrical advertising and has done some startling things with electric signs. Brown and electric illumination have always been closely associated in the minds of the people. The Duquesne Light Company, in one of its newspaper displays says: "W. S. Brown, the gun merchant of 523 Wood Street, is not only a progressive merchant, but a public spirited citizen. He is usually in the front rank of those who are ever advancing the interests of Pittsburgh. He is a believer in electric signs and by their use he has made his name and business so well known that the sportsman's first thought, when he needs firearms, fishing tackle, cutlery or athletic goods, is of Brown, who burns his name into the public mind with an electric sign. Here is what W. S. Brown writes us of our electric-light-service: "'Business men should surely appreciate the development in electric sign advertising, which has now become of such general use. We have found that it calls attention equally of those who know and those who do not know our place of business and we feel that it has been productive of good results. We are sorry there is not more public lighting on our streets and believe it would be of benefit to our city.'"

The remainder of the ad follows: "Electric signs not only benefit the merchant using them, but they benefit the general public by giving better illumination to the streets. It is the well-lighted city which is attractive to strangers, and usually wide awake and progressive. The merchant who hangs out an artistic electric sign not only helps himself by increasing his business, but he is considered one of the live wires who is always foremost in his community."



Sign sketch contributed by the Greenwood Advertising Company, Knoxville, Tenn., of a design built for the Hope Brothers Company.

The feature of this sign is the double-face clock with glass dials located in center of sign. This clock is equipped with Betts & Betts "Baby" type self-winding clock mechanism, the capacity of which is clocks 30 inches in diameter.

There are 116 receptacles for 10-watt lamps, which are arranged to flash first on one side, then on the other.

Writing of the value of slogan signs, Stuart C. Irby, of the Hattiesburg Traction Company, says: "Two years ago we gave to the city a 1,200-lamp slogan sign, which advertises the fact that Hattiesburg is the center of a circle formed by the cities of Meridian, Mobile, Gulfport, New Orleans, Natchez and Jackson.

"From every standpoint the sign has proven an excellent investment. It has acted as a great stimulator for the sale of electric signs and has strengthened the friendly relations between this company and the public."

Electrical Construction

LIGHTING DETAILS FOR ILLUMINATION OF PAGEANT AND MASQUE OF ST. LOUIS.[1]

By Arthur I. Jacobs.[2]

This article describes the large temporary electrical installation of the huge Pageant and Masque of St. Louis, which will be held from May 28 to 30. The installation is noteworthy as it involves the temporary illumination of a great stage area in an efficient manner without an excessive initial cost. Several difficulties were experienced in finding apparatus of a suitable nature for the illumination of the stage; and in the case of the footlight reflectors, extensive experimenting resulted in the development of a special reflector.

The site in Forest Park, which has been selected for the production of the Pageant and Masque of St. Louis, which will be held from May 28 to 30, inclusive, to celebrate the 150th anniversary of the founding of the city, is probably the most wonderful natural amphitheater adapted to such purposes. It is formed by a concave hillside, known as Art Hill, extending from about 200 feet north of the north facade of the Art Museum, at the top, down to the south bank of the main lagoon, over part of which has been built the enormous stage. This hillside forms the seating area for the audience and commands an unobstructed view of the stage below from any part of it. This area embraces about 330,000 square feet or 7.6 acres and spreads out before the stage in the form of a huge fan, 530 feet wide at the bottom and 1,100 feet wide at the top, and having a length of 440 feet. In this fan will be placed seats for 43,000, and there will be standing room for 50,000 more.

Illumination of Amphitheater and Lagoon.

The main objects sought for in illuminating this large area were fair uniformity of illumination, absence of glare in the eyes of the audience and the minimum of obstructions in the shape of lamp standards or wires. These objects have been attained by the use of 24-inch searchlights placed on the roof of the Art Museum about 200 feet back of the slope. There will be four of these searchlights, about 50 feet above the top of the slope and spaced approximately 110 feet apart. They are nominally of 10,000 candlepower each, having Mangin mirrors instead of the ordinary silvered copper reflectors. The doors are made of a series of linear plano-convex lenses, set vertically in front of the case, their purpose being to spread the light uniformly in a horizontal direction. The angle of diversion and the spacing of lights is such that the rays from adjacent lights overlap, making the illumination more uniform and providing against the possibility of total darkness at any point on account of the failure of any one of the projectors. Energy for these lights will be taken from a single-phase 2,300-volt underground line serving the Art Museum from the Union Electric Light & Power Company's main on Skinker Road. A 25-kilowatt motor-generator set comprising a 220-volt alternating-current, single-phase Wagner motor and 115-volt direct-current generator, has been installed in the basement for obtaining the direct current needed for the searchlights.

The main lagoon at the foot of the slope is 275 feet wide by 920 feet long, north and south. Near the southern end, that is, nearest the amphitheater, there is a branch on either side approximately 45 feet wide, running east and west. The bank of the main lagoon at the foot of the slope is circular in form and between it and the front of the stage which is built over the lagoon, there is left a body of water about 120 feet wide approximating the crescent of the Mississippi in front of St. Louis.

This stretch of water measures about 920 feet in length, 500 feet of which will be illuminated by 133 250-watt tungsten lamps spaced two feet apart at the center and five feet apart at the ends. Boats will come out of darkness, becoming better and better lighted until they reach the landing where the illumination is the most intense. The effect will be heightened by the use of dimmers, described later, by which the lamps can be brought gradually from darkness to full brilliancy and vice versa. The lamps will be placed in white-enameled steel reflectors, mounted along a timber frame built against the steep bank of the lagoon about three feet above the water, and out of sight of the audience. The reflectors are of very odd shape, and are manufactured by the Benjamin Electric Manufacturing Company for illuminated sign work, but their distribution is such that by reversing them they are peculiarly adapted for this use. Supplementing the 250-watt lamps, there will be two 18-inch searchlights on the south shore. These lights will be set in pits, the roofs of which will be flush with the ground surface and unseen by the audience while the front facing the water will, of course, be open. These lights, like those on the roof of the Art Museum, will be equipped with diverging lenses. The lens doors are, however, removable and when required by the action of the Masque, the searchlights will be used without them for throwing intense lights on the principal characters. The energy for both the searchlights and tungsten lamps will be brought across the water in separate lead-covered cables from the switchboard on the stage, as shown in Fig. 1.

Illumination of Stage.

The stage is 320 feet wide in front, 510 feet at the rear and is 200 feet deep. It is built on piles driven into the soft bottom of the lagoon and has a slope from front to rear of four feet. On each side of the stage is a tower seven feet by 12 feet at the base by 40 feet high, which corresponds to the proscenium arch in a theater. In one of these towers will be stationed, during the performance, the pageant masters, stage director and electrical director. Here also will be placed the switchboard from which all stage and lagoon illumination will be controlled.

The immense size of the stage and the absence of any overhead structure from which to support top lights, made the matter of proper illumination of the stage a vexing problem. Any overhead system of suspension wires fastened to towers and back drop would, in order to bring the lamps where needed, be not only more or less com-

1 Paper delivered before the League of Electrical Interests on April 28.

2 Chairman Lighting Committee.

plicated, but would be unsightly and is actually needed; this rigid fixtures in front of the lamps, would interfere with the view of the stage from the higher portions of the amphitheater.

The plan, as finally adopted, consists of foot and wing-lights consisting of special 18-inch searchlights and of standard theater spot-lights. The footlight reflectors are different from the ordinary theater footlights both in design and application. It was imperative that all the light be thrown directly across the stage on account of the absence of any overhead drops to reflect the light back on the stage and on account of the great distance of the back drop from the front of the stage which would cause any light thrown upward beyond a small angle to be totally lost. Several short sections of differently shaped reflectors were made and many photometric observations of each were taken by means of a Sharp-Millar illuminometer to determine their distribution-of-light characteristics. By this means a very efficient reflector was developed and knowing its characteristics, the total illumination at any point due to any given length of reflector was readily calculated. Fig. 3 shows the construction of the reflector which was developed, while curve 3 of Fig. 2 shows the light distribution as obtained with this reflector in comparison to that obtained with two earlier types of reflectors. The reflectors are of polished tin held in wooden frames 28 inches apart. They set entirely above the stage, but on account of the rise of the stage from front to rear, and the fact that the lowest seat in the amphitheater is several feet above the stage, these reflectors will offer comparatively little interference with a view of the stage. The lamps are 250-watt, placed 14 inches apart with the filaments parallel to the reflector surface. There are three colors, clear, amber and red, each color being on a separate three-wire circuit connected to dimmers. The clear lamps are divided into two circuits, the lamps on each half of the stage being independently controlled. The intensity of illumination obtained with an 800-foot length of clear footlights is about 4.5 foot-candles at a distance of 50 feet from the reflectors.

Wing-lights having 15-foot polished tin reflectors of same design as the footlights and equipped with 250-watt clear lamps, will be placed back of each wing. One 18-inch searchlight will be placed on a platform back of each tower, 30 feet above the stage, and one of the same size will be placed on a 10-foot platform back of the first wing on each side of the stage. These will illuminate the area not adequately taken care of by the footlights and will provide the light from above as necessary for proper illumination. At the

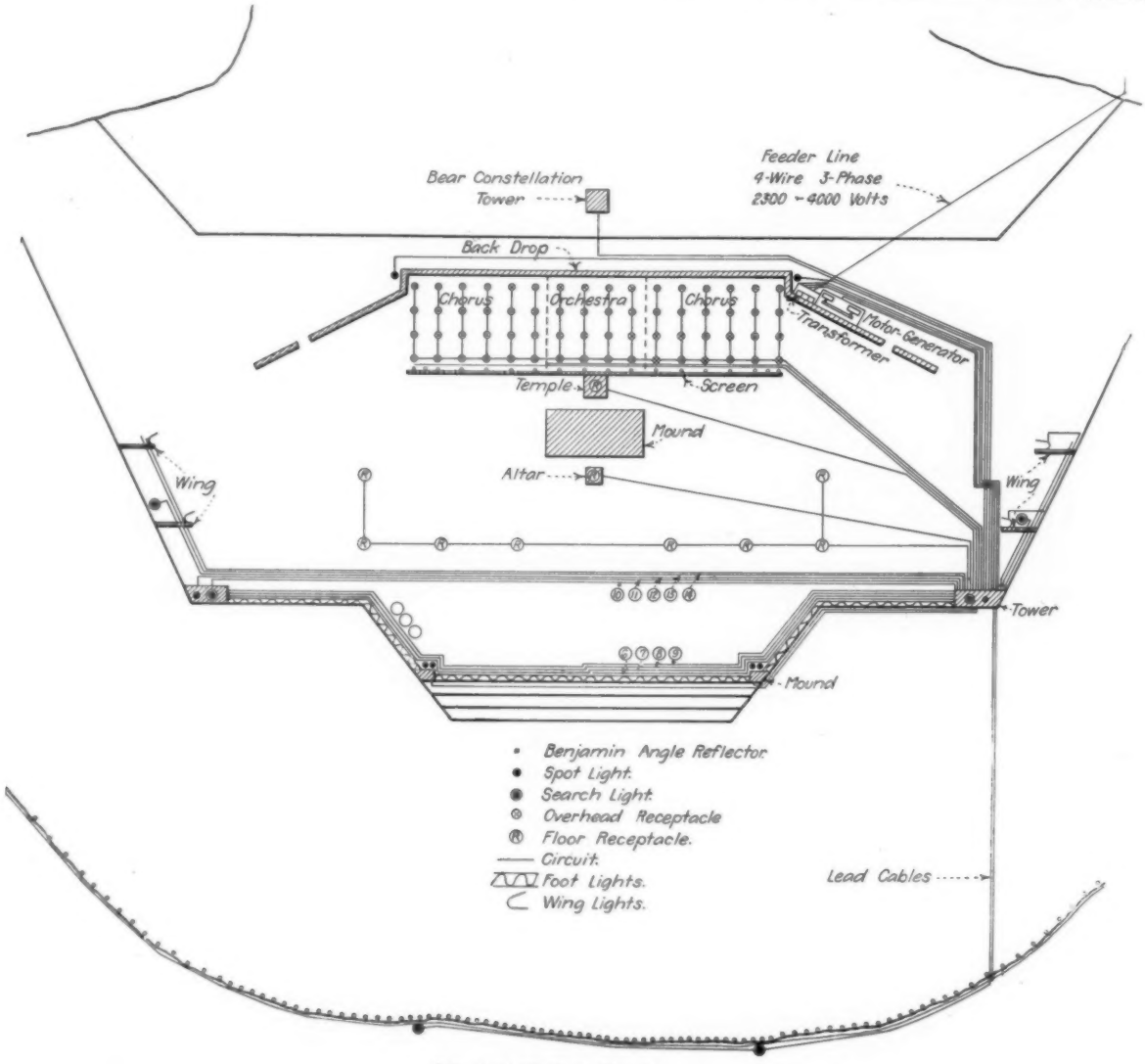


Fig. 1.—Layout of Circuits.

same time they will tend to soften the shadows from the footlights. Each will be equipped with a diverging lens and color screens. For picking out principal characters six 6-inch standard theater spot-lights with color wheels will be used. Three will be placed on each side of the landing at the front of the stage.

The background will be iluminated from the top of a screen shielding the orchestra and chorus in the back part of the stage from view. For this purpose 15 250-watt lamps having the same type of reflector used around the lagoon will be employed. Only a dim illumination is required for this purpose. Lighting for the orchestra and chorus will be by 60-watt lamps in

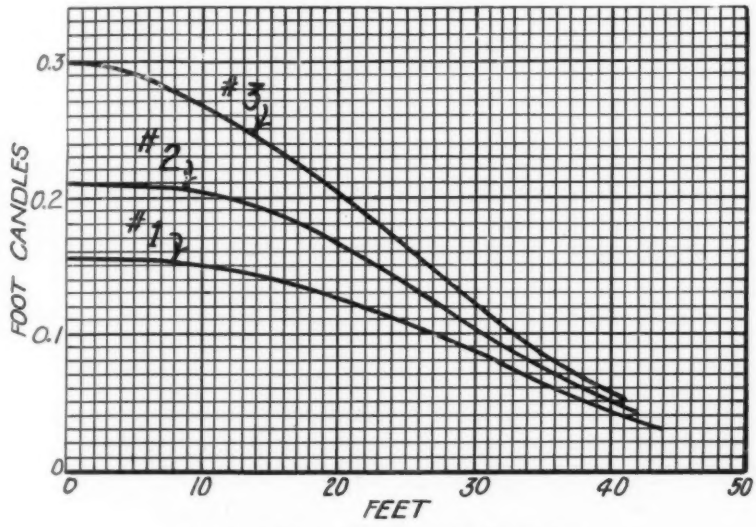


Fig. 2.—Footlight Reflector Intensity Curves.

conical metal reflectors strung between the screen and background. There will be 50 lamps above the chorus averaging 0.6 watt per square foot of floor area and 28 lamps above the orchestra averaging 1 watt per square foot of floor area.

Many receptacles will be used on the stage for special lighting purposes, among which will be eight receptacles for bunch lights on standards. The latter will be used for zone lighting for separate groups of dancers. In addition there will be several special electrical effects, among which may be mentioned the constellation of the Great Bear, 40 feet high, showing the outline of the Great Bear by about 200 four-candlepower carbon lamps and the stars of the Big Dipper which will consist of seven 60-watt tungsten lamps, set in cupped reflectors to give the effect of radiating rays of lights. The stars will be made to flicker by means of a flasher run at high speed. There will also be a five-foot flaming sword which is brought up the river with the child "St. Louis." It is carried to the mound where it is planted in the earth to the confusion of all the enemies of St. Louis, who attempt to wrest its rightful heritage from it.

Energy for the lagoon and all stage lighting will be brought to the northeast corner of the stage by a three-phase, four-wire, 2,300-4,000-volt line on temporary poles from the Union Electric Light & Power Company's line at DeBaliviere and Lindell Avenues. Secondary alternating-current distribution for incandescent lamps will be by three separate single-phase three-wire, 115-230-volt lines to the switchboard shown in Fig. 1.

The searchlights and spotlights require direct current for proper operation and for this purpose a motor-generator set, consisting of a 75-horsepower, three-phase, 220-volt Wagner motor belted to a 115-volt, 55-kilowatt generator will be installed as previously described. The transformers and the motor-generator set will be placed on the stage back of the east wing of the background.

The switchboard will be located in the east tower. It will be in two sections, the upper section for direct-current control and the lower section for alternating-current control. Each of the three main single-phase circuits will control a separate color. There will be 61 circuit switches, placed on the board in the same relative position as the arc and lamp groups which they control. With the exception of the three main switches on the alternating-current lines, all alternating-current switches will be double pole, the neutral being carried through solid.

There will be two sets of buses for each main alternating-current circuit, a dimmer bus and a straight-through bus. There will be four sets of dimmers, one set to each of the three main alternating-current circuits and a separate one for the shore-circuit inserted between the main switches and the dimmer buses. The straight-through buses are connected directly to the main switches. Every branch circuit which requires dimming is connected through a double-pole switch to each set of buses. As each main circuit controls a separate color, any color may be dimmed separately or any two or all three may be dimmed simultaneously or in any order desired. By means of the switches on the straight-through buses any or all branch circuits may be thrown in directly across the line, while other circuits of the same color are being dimmed. In fact, all combinations but that of different degrees of dimming of two circuits of a single color at the same time may be obtained. The latter combination will not be required.

The ordinary form of theater dimmers, on account of the immense cost entailed for the large capacities required, were out of the question. Water rheostats will be used instead. One terminal will lie at the bottom of the barrel while the other will be suspended from a cord pressing over a pulley and counterweight. The movable terminal will be a grate casting so as to enable

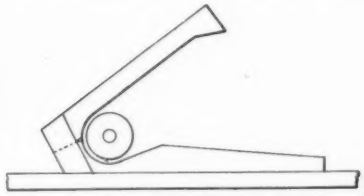


Fig. 3.—Footlight Reflector.

it to drop readily through the water. A set consists of two barrels, one on each outside wire, the neutral running straight through.

For the proper co-ordination of all the activities of such an enormous production an extensive telephone system will be installed. All arc-light operators will wear head telephones. The four searchlight operators on the roof of the Art Museum will be on one circuit, and the twelve or more operators on the stage will be on two other circuits. By grouping the two transmitters on the stage circuits close together, orders to any two or more operators may be given at the same time and will be heard by all. It can readily be seen how greatly this will facilitate the giving of orders and cues. In addition, a 20-line board will be installed with telephones in the wings and dressing tents and distributed at vantage points on the grounds. There will also be a telephone set in the audience from which an assistant stage director may communicate with the stage.

ELECTRICAL INSTALLATION IN A LARGE CLOTHING FACTORY.

New Kuppenheimer Plant in Chicago.

The manufacture of clothing is one of those industries in which close competition is necessitating careful attention to efficiency, so as to reduce production costs to the lowest point consistent with quality of product. This is bringing about the liberal use of electricity in plants of this kind. A good example of this tendency is the new factory of B. Kuppenheimer & Company, manufacturers of men's and boys' clothing, at Twenty-second Street and Western Avenue, Chicago. Many features about the electrical equipment of this factory are unique and therefore of special interest to the electrician.

Three of the ten former clothing factories of this firm have been consolidated in the new building, which accommodates about 2,500 employees. The building is four stories high and on the ground floor about 250 by 125 feet in area. The dimensions of the upper floors are about 250 by 48 feet, with a central wing to the north 66 by 77 feet. Mill construction is used throughout. In practically all parts of the building the walls are faced with white glazed brick, which with the liberal window area makes the rooms exceptionally light. The welfare of employees is provided for by a large dining room and kitchen, rest rooms and a hospital room on the ground floor, as well as ample toilet and locker rooms on each of the four floors.

Central-station electrical supply was adopted and a contract was closed with the Sanitary District of Chicago for three-phase 60-cycle current at 220 volts for power and 110 volts for lighting. In the alley back of the building two banks of step-down single-phase transformers were especially installed for the plant by the Sanitary District, as shown in Fig. 1. The three transformers seen on the right are for power, while the three on the left are for the lighting supply. Three delta-connected 220-volt, 400,000-circular-mil feeders carry the power current and six independent 110-volt 500,000-circular-mil feeders carry the lighting current to the service entrance of the building, as shown in Fig. 2; the simpler plan of connecting the lighting transformer secondaries in delta right at the transformers was intentionally not used because it would have required larger and more unwieldy feeder cables. Gillette-Vibber Universal service fittings are used at the top of the three large conduits on the rear wall. At the bottom of these conduits junction boxes were placed to facilitate bringing the heavy cables through the wall.

Fig. 3 shows how these cables emerge on the inside of the boiler-room wall directly into the upper portion of the steel cabinet for the service switches. The 600-ampere power switch is at the right. At the left is the 1,200-ampere lighting switch to whose fused terminals the six individual cables from the transformers are delta-connected in pairs. The polyphase lighting meter is to the left of the steel cabinet and on each side of it is a current transformer connected in the standard manner for measuring three-phase loads. The two cables from each of the outer phases are spliced before reaching their current transformers and then are again run as two cables in parallel, passing through conduit under the floor to the large distributing cabinet in the adjoining room. The power meter and its current transformers are seen at the right, the connections here appearing to be simpler because only single cables are used.

Since this factory has no isolated generating plant, an elaborate switchboard was decided to be superfluous. There is provided instead the large

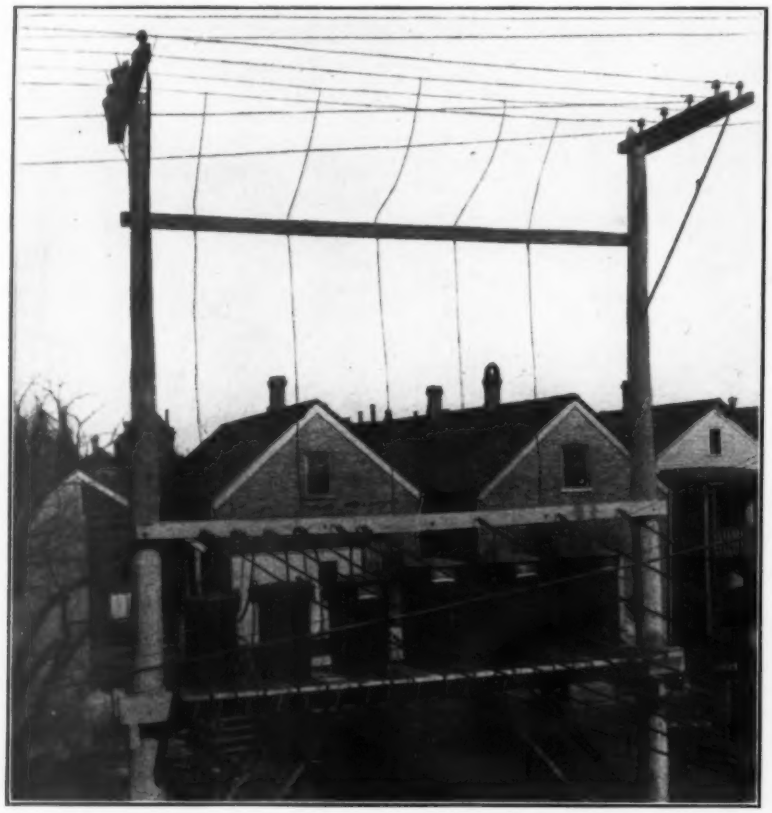


Fig. 1.—Lighting and Power Transformers for Kuppenheimer Factory.

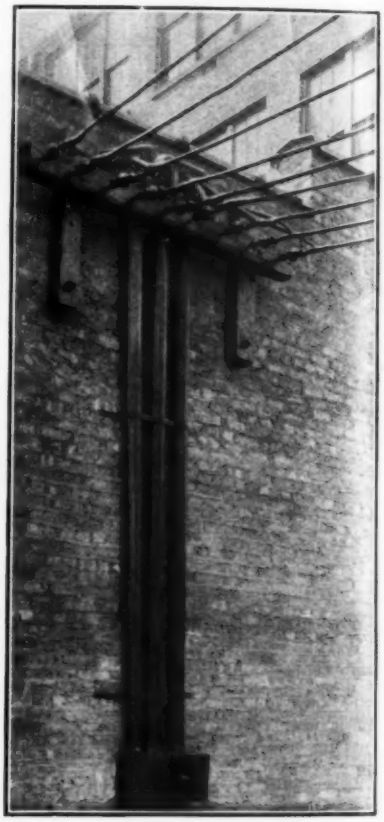


Fig. 2.—Service Cables for Building.

distributing board shown in Fig. 4. This is at the south end of the pump room and is mounted in a steel cabinet. This cabinet is one of the largest ever built of this type and when empty can hold five men with room to spare. It is made of standard No. 12 sheet steel and is mounted on and braced with angle irons. Double hinged doors with vault handle and lock permit closing and sealing the cabinet against tampering with the switches or fuses.

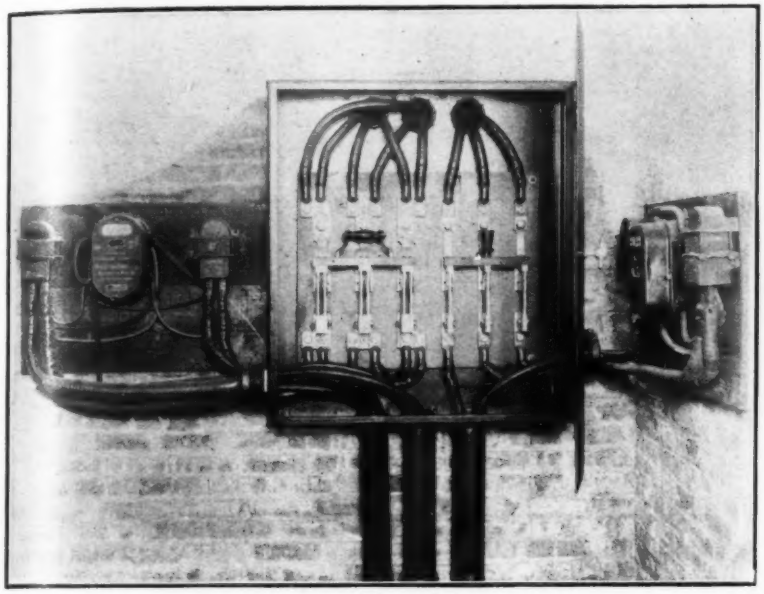


Fig. 3.—Service Switches and Meters.

The left side of the board is for the power circuits. The main power switch has a capacity of 600 amperes, as has the first branch-circuit switch which controls a 300,000-circular-mil feeder that is carried in 2.5-inch conduit running up as a riser to all of the floors and supplying motor circuits for sewing machines and any other machines used in the clothing manufacture. A 100-ampere reserve switch is provided for possible future power needs. The other switches are one 60-ampere for the sprinkling-pump motor, one 20-ampere for the house-pump motor, one 15-ampere for the vacuum-cleaner motor, and a 10-ampere switch for the ejector-pump motor.

The right side of the board controls the lighting circuits, which were all laid out originally, according to the specifications, as 220-110-volt three-wire single-phase circuits; therefore fuses were omitted in the middle or neutral wire; subsequently three-phase supply was brought in for lighting as well as power, but the original layout of circuits was approved. The main lighting switch has a rating of 1,200 amperes. Five main branch feeders are tapped from the buses through as many 300-ampere switches. Two of these lighting feeders are run as 300,000-circular-mil cables and the other three as 250,000-circular-mil cables, all of them being in 2.5-inch conduit running as risers supplying five distributing cabinets on each of the floors. The small switch shown on the top of the right side of the distributing board supplies a lighting-circuit cabinet in the boiler room, from which the lighting of this and the adjoining machine shop, pump room, and store rooms is controlled. It will be observed that the outer poles of the main lighting switch are equipped with double fuses in parallel. Each of these fuses is rated at 600 amperes. The branch circuits are led from the sides of the board into conduits run upward from the top of the cabinet, as shown in the illustration. This board was laid out by E. Miller, superintendent of the contracting firm of J. L. Burgard. Mr. Miller is seen standing at the right in Fig. 4. The work of assembling and installing the board was in charge of John Foster, Mr. Burgard's foreman, who is seen at the left in the illustration.

In laying out the entire electrical installation very liberal provision was made in the main feeders for carrying considerably more than the present connected load or that immediately in prospect. Consequently it will be possible to add greatly to the number of lighting circuits and to the motors and to install other electrical equipment without requiring alterations on the distributing board or feeders. The specifications provided for a total of 408 lighting circuits, of which probably over one-third will be in reserve; the power load likewise will likely be below the total provided for.

All of the wiring in the building is in Buckeye rigid iron conduit which is neatly run on the ceilings parallel with or at right angles to the walls. Marion New-Code rubber-insulated wire is used throughout. Appleton Unilet fittings are generally used instead of bends; these greatly facilitated the installation.

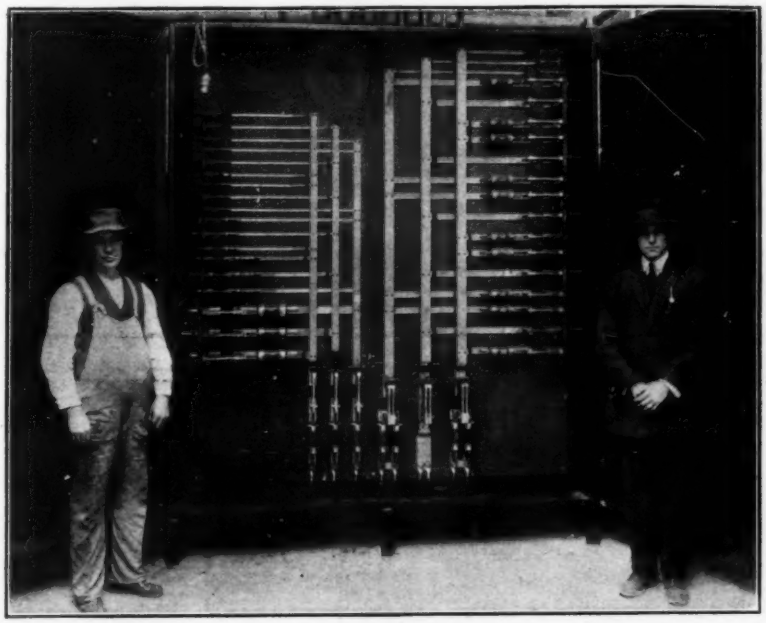


Fig. 4.—Main Distributing Board in Steel Cabinet.

Porcelain-covered three-wire Unilet fittings are placed at the ends of all motor conduit runs. All wall switches, and outlets and all ceiling outlets are in Unilet boxes.

Another corner of the pump room is shown in Fig. 5. At the left is a 3.5-by-5-inch triplex sprinkler pump gear-driven by a five-horsepower motor for operating the Globe automatic sprinkler system with which all parts of the building are equipped. Adjoining it is a suction pump chain-driven by a three-horsepower motor for the Richmond vacuum cleaning system. At the right is the control board for a 110-volt, six-ampere Held ozone water sterilizer. All of the drinking water is first filtered, then treated with ozone from this sterilizer and circulated to the drinking fountains on each floor. Aside from steam-driven boiler-feed and vacuum pumps, there is also a three-horsepower motor-driven Yeomans house pump automatically controlled by a float switch at the roof tank with a relay at the motor. The machine shop has a five-horsepower motor. The freight elevator is driven by a 15-horsepower motor at the top of the shaft. There is also a motor-driven mixing machine, a potato-peeling machine and an electric dish-washing machine in the kitchen.

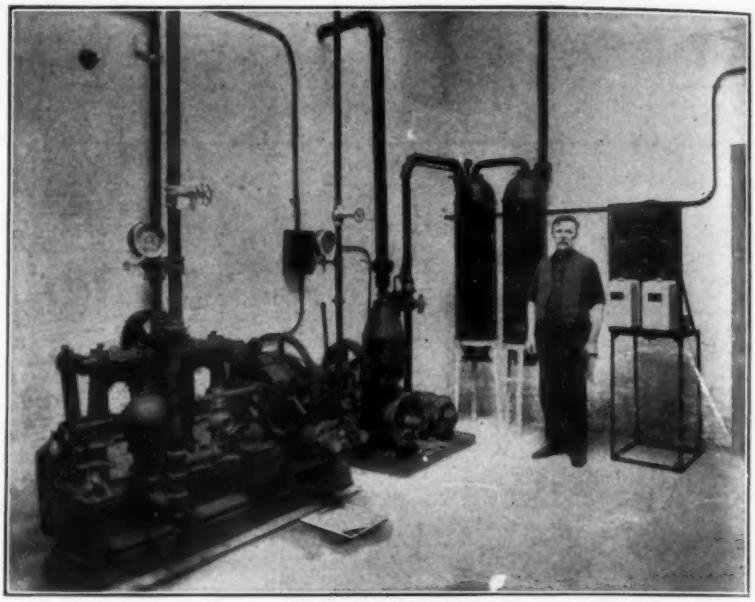


Fig. 5.—Motor-Driven Pumps and Ozone Water Sterilizer.

The clothing-machine power feeder referred to above is run as a riser along one of the five lighting-circuit feeders and at each floor there is placed on it a steel junction box, as shown at the right in Fig. 6. From this box a branch feeder is run to a motor-circuit cutout cabinet. On account of lack of room the one shown in Fig. 6 had to be placed at the left of the lighting cabinet. The use of Unilet angle fittings mentioned above is well shown in this illustration. From this motor cutout box five branch circuits are run down in conduit to the ceiling directly below the floor and from there as many motor groups are supplied. At each motor outlet a junction box is placed near the ceiling and a short piece of conduit is run up through the floor to the motor terminal fitting. The wires pass through this to the 30-ampere fused motor switch, which is inclosed in a steel box. Fig. 8 shows the arrangement. Group drive is used

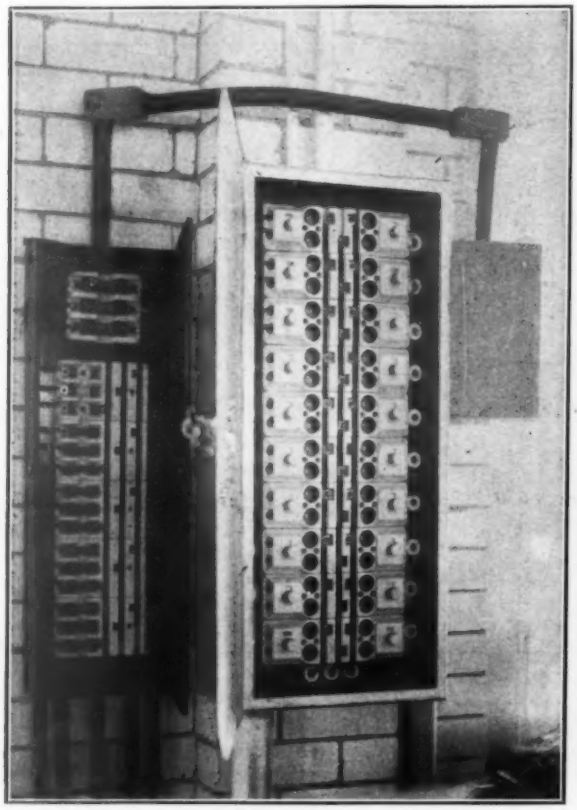


Fig. 6.—Motor and Lighting Cutout Cabinets.

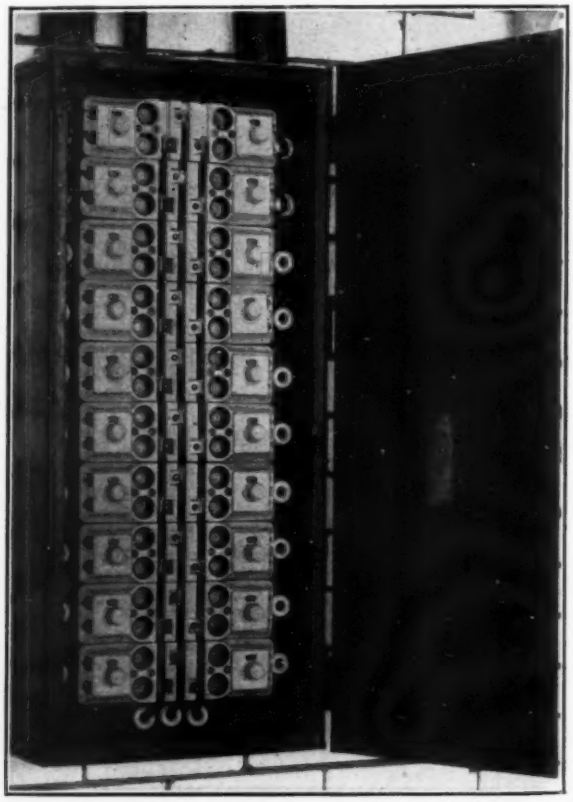


Fig. 7.—Closer View of a Lighting Cabinet.

for all sewing-machine tables. The motor drives the line shaft continuously and the individual machines are started and stopped by pedal control of a belt shifter. Various numbers of machines up to 17 are connected to one motor; the sewing-machine motors are General Electric three-phase induction motors and vary from one to three horsepower in size; 25 of them have been installed, most of the machines being on the top floor.

Fig. 8.—Motor Drive for Sewing-Machine Tables.

Although the building has been occupied nearly two weeks, none of the lighting fixtures has yet been installed. All the circuits for general lighting have been completed, however. This general lighting is provided for in nearly all cases by a single-lamp fixture at the center of each bay. In the large work rooms the bays are 16 by 22 feet in dimension and each will have a 250-watt tungsten lamp in a Maxolite enameled-steel socket reflector mounted about 9 feet 6 inches above the floor. In the pressing and sponging departments 110-volt, 350-watt, alternating - current Cooper Hewitt lamps with reflectors will be used, since it has been found that mercury-vapor lamps show up creases better than other lamps; some of these lamps will have color-correcting reflectors. About 40 mercury-vapor lamps will be installed.

The circuits for general lighting are laid out almost entirely so as to have only two lamps per circuit, 250-watt lamps being assumed for this service. These circuits for general lighting are the upper ones in each of the lighting cabinets, of which there are five on each floor, four in the long work room and one in the north wing. One of these cabinets is shown in the middle of Fig. 6; a better view is that in Fig. 7. These steel cabinets are very neatly arranged, being made up of Perkins porcelain panelettes with indicating snap switches mounted on sheet-steel plate with a three-inch wiring compartment in the rear. The branch circuits pass through porcelain bushings into this compartment and then proceed in conduit to the lighting outlets. Each cabinet has provision for 20 branch circuits, of which only four or five are now connected for general lighting.

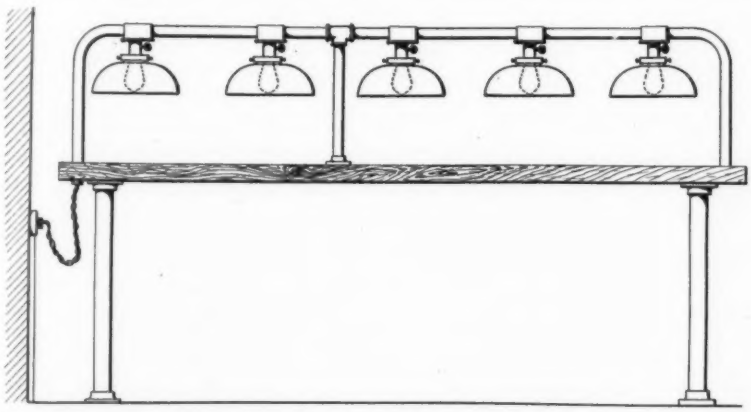


Fig. 9.—Scheme of Lighting for Handwork Tables.

In all clothing factories it has been found that operators working on dark materials, such as most men's clothing, insist on local lighting where close work like sewing is required. For this purpose it is planned to provide considerable special lighting of work tables, for which most of the as yet unwired branch circuits shown in the cabinets will be used. The conduit runs for this table lighting will be placed on the ceiling directly beneath the floor, being arranged much like those for the sewing-machine motor circuits described above. Many of these tables for finishers and button-hole stitchers are placed at right angles to the outer walls. The conduit will be brought through the floor to a Unilet box with Hubbell wall receptacle, from which a plug and short flexible-cord connection will be used to the lighting equipment on the table.

Fig. 9 is a diagram of the proposed lighting of these tables, which are 14 feet long by 18 inches wide, accommodating five persons on each side. It will be observed that a simple and inexpensive, but very effective, arrangement has been devised. Standard conduit and fittings are used. For most of the tables five 40-watt lamps will be mounted over the center line, each lamp being equipped with an 18-inch enameled-steel dome reflector to throw the light well over the laps of the operators on each side of the table. For the button-hole finishers individual 20 or 25-watt lamps will be provided by having a short piece of conduit run at right angles from the center condut line so as to bring the lamp and steel reflector directly over the handwork being done. Keyed sockets of the screw-cap type will be used. The mounting height of the lamps, as well as the general arrangement has been studied out with great care so as to throw the light where it is actually needed; thus rigid fixtures can be used, since there is no need for adjustment with its attendant loosening and wear of the fixture parts.

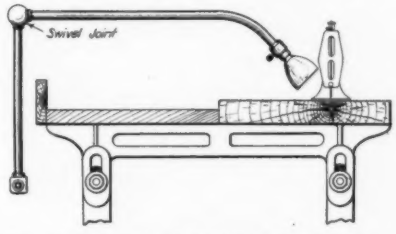


Fig. 10.—Scheme of Lighting for Sewing-Machine Tables.

The special lighting of the sewing-machine tables is made clear from Fig.

10. The conduit is run under the floor to the nearest end of the table, then through the floor and continued underneath the rear edge of the table about two feet above the floor to eliminate vibration. At a point opposite each individual machine a tap is made with a Unilet fitting and one-half-inch conduit is brought up along the edge of the table to a swivel joint at the top, from which a gooseneck arm leads so as to bring the lamp and its enameled-steel reflector close to the needle. The swiveled arm can be swung to one side 90 degrees, so as to bring it entirely out of the way; otherwise the fixture is rigid. About 250 of these fixtures will be used. It is believed that this fixture arrangement will be found very satisfactory, being low in first cost and maintenance, while bringing the light exactly where it is needed; vibration will probably not be be serious enough to affect the life of the tungsten lamps to be employed.

Aside from the power and lighting equipment installed and contemplated, there has been put in service an Edwards fire-alarm system with 15 pull boxes and gongs in various parts of the building. Although of the low-voltage type and operated by batteries, all the wiring for the system has been run in three-fourth-inch conduit with standard Unilet conduit fittings to insure keeping the wiring intact. An annuniciator has also been installed in the boiler room, equipped with call bell and connected to all floors and the elevator.

The architect of the building was Samuel N. Crowen. The plumbing, heating and heavy electrical work was laid out by John Small, of Hyland & Green, consulting engineers. The installation of the sewing-machine motors, as well as the local lighting of the tables was designed by M. E. Ames, who acted as consulting engineer on these matters. All of the electrical work in the building was installed by the firm of J. L. Burgard, 753 West Fifty-fourth Place, Chicago, Ill.

Cincinnati Contractors Form New Organization.

A new organization of electrical contractors in Cincinnati is in progress of formation, as a branch of the Jovian Order. In response to a recent appeal by Mayor Spiegel, delivered in an address at a Jovian meeting, for closer relations with the city on the part of the electrical trades, it was stated that the new organization, composed exclusively of men handling construction work, had for one of its purposes close co-operation with city officials, and that this purpose would be fully carried out.

New Wiring Rules in Louisville.

New rules applying to electric wiring in Louisville, Ky., were promulgated recently by the Louisville Electrical Clearing House. These rules became effective on May 1, and applied to all work figured after April 23, provided all jobs before then were listed with the electrical inspectors. The additional rules, are as follows:

Bath Rooms.—Fixtures and drop lights not controlled by switches must be equipped with porcelain key sockets or insulated pull-chain sockets.

Motors.—All alternating-current motors of over one horsepower must be equipped with double-throw spring switches with running fuses, when not equipped with approved starters which have the above mentioned protection.

Loop System.—All concealed work must be wired under this system, with boxes at each outlet except on front porch ceilings.

The order, which was addressed to all electrical contractors operating in Louisville and Jefferson County, Ky., was over the signatures of E. L. Kopf, electrical inspector for the Kentucky Actuarial Bureau, and Gus Ansbach and E. J. Theobald, city electrical inspectors. E. C. Knoop, bookkeeper for the Kentucky Actuarial Bureau, is secretary of the Clearing House. Its meetings are held on the second Monday of each month. The third monthly meeting (the Clearing House is of recent organization) was held on May 11. The meetings are of educational nature and are open to all those who are interested in electrical work.

Among the Contractors.

The Cumberland County Court House at Carlisle, Pa., will be completely wired for electric lights by Greybill & Company, a contracting firm of York, Pa. The installation will be supervised by A. E. Harris, in charge of the local branch of the firm.

The L. G. Robbins Electric Company, of Salt Lake City, Utah, has recently moved its place of business from 67 East First South Stree: to 138 East First South Street.

Kohler Brothers, Chicago, have recently been awarded the contract for installing two switchboards, a 200-horsepower generator, a number of incandescent lamps, and 17 motors totalling 190 horsepower in the plant of the Illinois Vinegar Manufacturing Company, at 213 West Forty-eighth Street, Chicago.

The contract for installing 21 motors totalling about 582 horsepower in the plant of the Lincoln Ice Company, at 4628 Greenview Avenue, Chicago, Ill., has been awarded to C. Grunhow, electrical contractor, Chicago, Ill.

The Counties Gas & Electric Company, of Norristown, Pa., has awarded a contract to F. J. Boas, a contractor, to erect a new power house in Norristown.

Electrical service of the new "Old Kentucky Home Hotel," in Bardstown, Ky., near which stands the original "Old Kentucky Home," will be of metropolitan proportions, according to present indications. The hotel is nearing completion and soon will be open for business. The electrical work is being done by Matthew & Allen, electrical contractors of Bardstown.

The Aitken Electric Company, general electrical contractors, Cleveland O., has been incorporated with a capital stock of $10,000, by S. E. Wilson, R. M. Zimmerman, George R. Aitken, S. M. Aitken and S. E. McFarland.

The Baker Electric Construction Company has secured the wiring contract on the new Whittier School annex in Kansas City, Mo.

The Pocatello Electric Supply Company, Pocatello, Idaho, of which H. G. Shafer is manager, has just commenced work on the wiring, fixtures and intercommunicating telephone system in the new Fargo apartment house. Another contract just begun is that for the wiring and fixtures for the new Kiscikia office building. This company has also recently completed the wiring of the two transfer sheds, each 490 feet in length, and the combined freight house and offices, 392 feet in length, for the Oregon Short Line Railroad at Pocatello. This work was in conduit throughout and included fixtures and panelboards.

Lloyd Donaldson, electrical contractor of Boise, Idaho, has recently moved from 221 South Tenth Street to an attractive and well located store at 305 North Ninth Street. Among the contracts completed by Mr. Donaldson in Boise were the wiring for the Auditorium Theater and that for the Grand Hotel.

The Avery-Loeb Electric Company, of Columbus, O., has the contract for installing 18 or 20 motors, with necessary wiring, for the Godman Shoe Company, of that city, which runs factories at Columbus and two nearby towns. The contract amounts to about $1,500.

The work of putting in 20 motors for the North Columbus Lumber Company, Columbus, O., has been let to the Sackett Mine Supply Company, of Columbus, O., at a bid of $2,000.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Replacing Springs on Rheostats.

To replace a spring in an ordinary controller-type rheostat; put the spring in place on the handle, place the handle in place on the rheostat with one end of spring on handle, put a strong cord or wire on other end of spring and pull the spring into place, pushing its end into the retaining hole by means of a screw-driver. This will save the trouble of taking stop off the box when replacing a spring.

Roy Dean.

Soldering Iron.

I have found that a very handy soldering iron can be made from a copper terminal of an old arc lamp as shown in the accompanying illustration. A groove is filed in the short elbow, and the terminal attached to a twisted wire

Soldering Iron.

stem and handle. This iron is very handy for soldering joints in wires as the groove acts as a cup distributing the heat and solder very evenly.

C. E. Brown.

To Renovate An Old-Time Fixture.

Eight or ten years ago the old type of cluster fixture was much used for the illumination of store buildings and halls, but today people consider these fixtures objectionable both on account of appearance and on account of the glare that emanates from so much concentrated light. These fixtures can be converted into a semi-indirect type with little trouble. The large pancake shade which usually hangs above such a fixture can easily be removed, together with the usual 16-candlepower lamps. When tungsten lamps are inserted in place of the old carbon lamps and a glass-bowl reflector is hung below the fixture at such a height as to cover the lamps, an indirect fixture of pleasing appearance and good light distribution results.

L. E. Darling.

Cutting Holes in Cutout and Service Boxes.

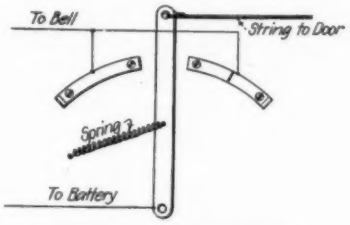
In cutting small holes in steel cutout or service boxes, I use a hole punch such as tinsmiths use. Holes made in this way will be burred on one side of the box but this burr can easily be removed by hammering. I found this method much quicker and less laborious than drilling. Fred Husar.

Prying Up Floor Boards.

In taking up old floors it is often difficult to prevent the old boards from splitting. I have found that by prying up the grooved side of the board first, the bottom edge of the groove will split off and the board can be replaced in apparently as good condition as before. H. W. Hanna.

Burglar Alarm.

The accompanying illustration shows a burglar alarm for use with a chicken coop or other outbuildings. It is arranged so that the opening of a door causes the string to pull the lever over where it will make contact with the metal piece on one side. After being pulled into this position, it will catch and remain there. On the other hand,



Burglar-Alarm Connections.

if the string is broken or cut the spring will pull the lever back until it makes contact on the opposite side. The two contacts on the board are connected together behind the board, so as not to interfere with the motion of the lever. The position of this device may be made to suit one's convenience and the string may be adjusted over pulley to suit.

William T. Estlick.

Joining Copper Tubing.

On inside work with high-tension currents copper tubing about 0.5 inch in diameter and in about 10-foot lengths is frequently used in place of the ordinary wire. For long runs the joining together of the tubes sometimes presents something of a problem, if neatness and mechanical strength are both desired. Having some pieces of hard-drawn copper trolley-wire a little larger in diameter than the inside of the copper tubing available, I threaded a four-inch length of the trolley wire with an ordinary stock and die. Similar threads were made on the inside of the copper tubing at the ends with a tap of corresponding size, the ends of the tubing being first squared off with a file. The piece of trolley wire was screwed half its length into the end of one of the pipes, the process being facilitated by the fact that the trolley wire was not round in cross section but one of the commercial grooved types, thus making the gripping of the wire with a wrench an easy matter. The end of the other tube was then screwed onto the piece of trolley wire which now projected from the first tube. The trolley wire hence served as a nipple, making a rigid joint that was hardly visible a few feet away, and one which did not depend on a soldered joint for rigidity. Solder, however, should be used to insure good electrical contact. L. E. Darling.

Protecting Conduit Threads.

On a recent job I had to make a number of offsets or bends in some pieces of conduit near the end of the pipe, and to avoid damaging the thread I took a piece of coupling of the same size and screwed it over the thread so that the latter was completely covered. I could then bend the conduit without injuring the thread.

William T. Estlick.

Device for Pull Chain Sockets.

On jobs where a number of fixtures having pull sockets are used the appearance of the place is often ruined

Device for Pull-Chain Sockets.

by pieces of string which are tied to the chain in order to bring them within reach. Such strings can be obviated by providing the customer with the device illustrated in the accompanying figure. It is constructed by fastening a buttonhook to a piece of dowel stick and pressing the sides of the hook together so that it will catch between the balls of the chain. With this it is easy to operate a chain socket without the use of strings.

William Fisher.

Straightening Wire.

Line wire is often kinky when ready to use. Kinky wire does not look well on open work and will sag more easily with age. A good and convenient way to straighten it when in this condition, is to fasten one end of the wire to an article near the floor and taking the other end to some distance, throw the wire into the air bringing it down with force enough to drive out the kinks. If this is repeated a few times the wire becomes straight and in good condition. Roy Dean.

Among the Supply Men

The Northwestern Electric Equipment Company Moves Into Its New Home.

The Northwestern Electric Equipment Company has moved into its new home at 174 to 178 East Sixth Street, St. Paul, Minn. This company has had a remarkable growth in the past 12 years and is today more than ever representative of what the electrical industry stands for—enterprise, progress and development.

In its beginning the Northwestern Electric Equipment Company amounted to practically "Frank B. Thompson, salesman." Specializing in Fostoria lamps and Triumph motors, he built up a business to such proportions that in 1900 a warehouse and selling organization were necessary in St. Paul. The Thompson Electric Company was organized with Frank B. Thompson as general manager. In its first year as an electrical jobbing business the firm amassed a volume of a little over $55,000. Growth was rapid during the next three years, the idea being to constantly improve the service, and in 1903 the firm name was changed to the Northwestern Electric Equipment Company. In 1911 the present organization was effected and Mr. Thompson became president of the Northwestern Electric Equipment Company. In the 11 years intervening he had built up the company from a point where in its first year it barely passed the $55,000 mark in volume until during the year ending January, 1913, its volume closely approached one and a quarter million dollars.

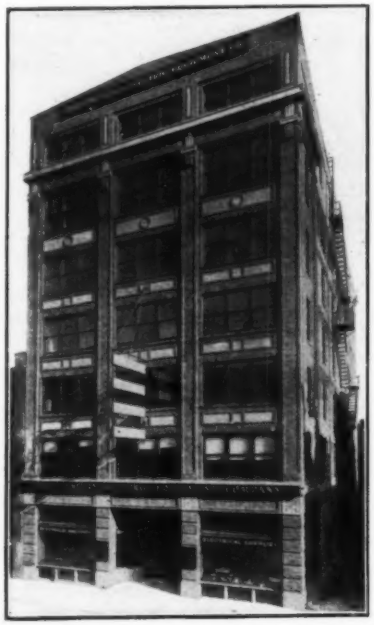


Fig. 1.—New Building of Northwestern Electric Equipment Company.

The new home is three blocks from the Union station and in the center of the wholesale district. It is the largest building in the middle west occupied exclusively by an electrical jobbing house. Built of reinforced concrete construction of the Turner type, 210,000 pounds of steel and 15,201 sacks of cement were used in the completed building. There is available 60,000 square feet of floor space and 700,000 cubic feet of space in the entire building, all of which, with the exception of 7,500 square feet of office space, is devoted to manufacturing and repair departments and stock rooms. Included in the electrical equipment are 13,600 feet of Greenfield-duct conduit, 72,000 feet of Americore wire for power, light, signal and bell systems, and 447 Fostoria Mazda lamps. The indirect system of lighting is used for the office illumination, 250-watt lamps being used throughout. The manufacturing department, shipping and stock rooms are equipped with 317 Holophone D'Olier shades. The city department is equipped with 27 Holophane prismatic glass shades. The entire interior of the building is given two extra coats of white paint to give a maximum light reflection. The Hackney electrically operated ventilating system is installed on the office floor.

The building is served with three elevators operated by motors aggregating 26 horsepower, and a Minnesota Manufacturers' Association gravity carrier and chute connects all floors in the building with the shipping room, facilitating the rapid assembling and filling of orders. Central-station service is used exclusively and the maximum electrical load is approximately 50 kilowatts. In addition to telephone connection with private switchboards with the Tri-City Telephone & Tele-

Fig. 2.—General Offices, Second Floor.

Fig. 3.—City Desk, City Department.

graph Company and the Northwestern Telephone Company, a complete system of intercommunicating telephones is installed, connecting every department in the building, utilizing 38 telephone extensions.

The demonstrating rooms are located on the first floor, showing industrial and residence fixtures, household electric devices, and the rooms are for the use of the company's customers. If so desired, a sale can be made in them by any of the retail merchant trade the same as in their own stores. The building is of fireproof construction and in addition is equipped with a complete automatic sprinkler system. The rear stairway is in a fireproof enclosure opening on every floor and directly to the outside, and the windows on two sides and the rear are made of reinforced fireproof glass.

The accompanying illustrations show the exterior of the building and illustrate various features connected with the several departments of the company's organization and equipment.

Mr. Thompson has associated with him a strong organization, prominent among which are the following personalities:

James M. Whalen, vice-president, started with the company nine years ago as manager of the machinery department. Before he was connected with the company he was with the foreign department of the General Electric Company, participating in the development of a number of important foreign installations. Mr. Whalen is still in active charge of the machinery department.

Albert J. Anderson is secretary and manager of the company. As sales manager of the Manhattan Electrical Supply Company, which position he held for four years before going with the Northwestern Electric Equipment Company, he acquired a pretty comprehensive knowledge of the electric equipment business. He started with the company as manager of the supply department and still has active charge of that branch of the work.

Others members of the selling organization include A. M. Baldwin, Jr., whose territory lies along the main lines in Minnesota, North Dakota and Montana; R. P. Payne, northern part of Minnesota; H. C. Wyatt, the southern half of Minnesota; L. J. Bridger, Iowa; J. L. Holmes, Wisconsin and the northern peninsula of Michigan; E. D. Yayo, South Dakota; J. L. Tucker, central Minnesota and North Dakota; R. W. Richardson, apparatus salesman; L. G. Mample, N. H. Snyder and F. G. Klein, Jr., city salesmen.

The credit department is under the direction of E. A. Oas, the purchasing department being managed by C. H. Ritter, and the shop and repair department is managed by H. M. Lyons.

The company publishes a monthly bulletin called the "Northwestern Buzzer." This is the pet of J. M. Hannaford, Jr., who is manager of the sales department, which has charge of both sales and publicity. The "Northwestern Buzzer" is one of the most interesting house organs published to the electrical trade and Mr. Hannaford's efforts in this direction have been of the greatest assistance to his organization and his fellow workers.

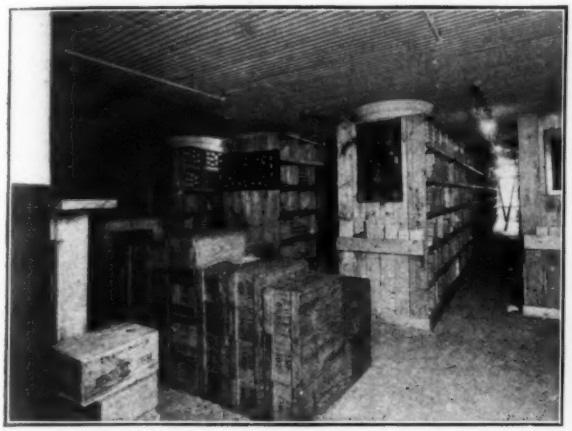


Fig. 4.—Section of Wiring-Device Stock Floor.

Fig. 5.—Battery and Wire Stock.

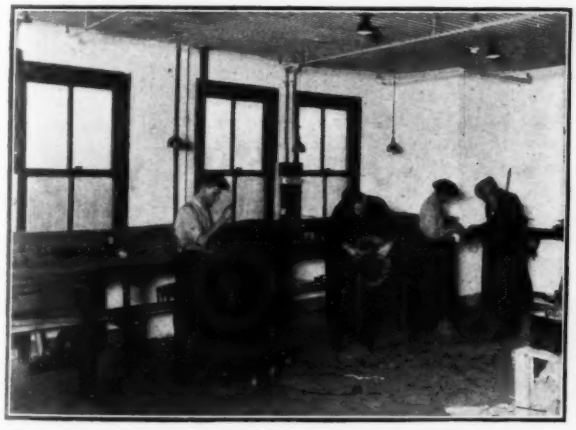


Fig. 6.—Armature-Winding Shop.

Fig. 7.—A Corner of the Panel Department.

M. P. McClure, of the Pittsburgh Electric & Manufacturing Company, Pittsburgh, Pa., reports that all sections the company operates in are fairly active. The company makes a practice each month of instituting a special effort on those electrical supplies most

commonly used such as wire, loom, sockets, lamp cord, porcelain, etc. The company is now in the midst of a vigorous campaign on these articles and is looking for a very successful issue. In handling a general line of supplies the company is experiencing an active demand.

The *Western Electric News* for May is dedicated to the office boy. There are forty pages of contributions either relating to or contributed by those who are either at present serving the company in that capacity or who have done so in the past. Both in its conception and subject matter the issue represents something unique in house organs.

The leading article, which deals with the office boy of 30 years ago, is contributed by F. H. Uhrig, western district manager of the company's Kansas City office. There are pictures of 39 Western Electric men now holding important positions with the company, all of whom started as office boys. This list includes a vice-president, an assistant general supply-sales manager, an assistant general superintendent of the factory, a traffic manager, an auditor, a credit man, three distributing-house managers, two assistant managers, two stores managers, two retail-stores managers, an engineer, a general foreman, two department foremen, four department heads, six salesmen and 10 others occupying miscellaneous executive positions.

Office Boys' Number, Western Electric News.

The May issue is a good idea. It cannot help but be an inspiration to everyone it reaches, and outside of its importance in this direction it demonstrates a record that can be duplicated by few other business organizations in the country. As the Western Electric boys feel, the record must stand unchallenged until someone offers a better one. The illustration herewith is a reproduction of the front cover.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

The Mount Whitney Power & Electric Company was authorized to issue $500,000 of its six-per-cent 30-year bonds to be sold so as to net the applicant 95 per cent of the par value. The proceeds are to be applied among other things to the completion of the Wolverton dam and to the construction of distribution lines and substations.

GEORGIA.

Changing Rates Fixed by Contract. In the decision mentioned in last week's issue, upholding the right of the Georgia Public Service Corporation acting under authority of the State Railroad Commission to abrogate contracts for electric power, and to charge an increased rate, the Superior Court has made the following important holding:

"Upon careful consideration of the contract in question, the order of the Railroad Commission, in re, Application of Georgia Public Service Corporation, for increase in commercial and residence and retail power rates, and of the adjudications of the (state) Supreme Court as to the jurisdiction and power of the Railroad Commission, after full and able argument by counsel, for the plaintiff and the defendant, I do not think that there is any doubt as to the power of the Commission to fix and regulate rates for the Georgia Public Service Corporation, and to require these rates to be uniform. The most serious question was whether a legal contract should be set aside even by the Commission with all its board powers. This question, however, is resolved by the principle repeatedly adjudicated, that such a contract was made, subject to the law, then in existence, giving the Commission plenary power to fix rates and to prevent discrimination, this having specially conferred upon the Commission long prior to the contract of July, 1912, and that both parties contracted subject to the public law conferring this absolute power upon the Commission.

"Recent decision of the Supreme Court of this state, as well as the uniform trend of judical opinions in construing statutes creating railroad and public service commissions, seems to leave no doubt as to the power of the Commission, at the instance of the consumer, or of the power company or of its own initiative to fix and regulate rates; and no doubt is left that not only is the power company bound by the rulings of the Commission as to maximum rates, but also as to discriminatory rates, and, of course, the consumer of light or power current must yield to the same authority when it condemns any contract, either in contemplation or in actual existence, as discriminatory, and so against public policy."

ILLINOIS.

The Western United Gas & Electric Company was authorized to put into effect a new schedule of rates and charges for electric service submitted by the company. The new rates will eliminate all concessions and discriminatory charges.

Rates to Stockholders. The Commission has issued a general conference ruling to the effect that it is unlawful to grant a lower rate to subscribers who are stockholders, directors and officers, that the subscriber who is a stockholder has no rights or privileges which are denied other subscribers, and that the stockholders must look to the profits of the business for return on his investment.

The Murphysboro Telephone Company was granted a certificate of convenience and necessity to construct and operate a telephone system in the village of Sessor in Franklin County. There is no other telephone company furnishing service in the village.

INDIANA.

The Indianapolis Light & Heat Company has been ordered to discontinue charging customers living outside the city limits of Indianapolis a higher rate than that charged residents in the city. The Commission found that there was no basis for the difference in rates and that the practice was therefore discriminatory. Other complaints against the company's rates are before the Commission alleging that discriminations exist in that several different rates have been offered individual consumers based on time limits of contract or other reasons, and the Commission has been asked to revise the entire schedule of electric rates.

The Union Light, Heat & Power Company has filed a suit in the Randolph Circuit Court asking that the order of the Commission, reducing the company's rate for natural gas from $1.00 a thousand feet to 56 cents, be set aside. The company claims that the rates ordered by the Commission are unreasonable and will not cover operating expenses.

NEW JERSEY.

"Seven Sister's Law." A case involving the constitutionality of the anti-trust law known as the "Seven Sister's Law" is being heard before the state Supreme Court. The American Malt Corporation and the American Malting Company attacked a recent decision of the Board of Public Utility Commissioners on the ground that the discretionary power exercised in withholding approval of a merger of the two companies was unconstitutional and the companies applied for a writ asking that the proceedings of the Commission be set aside.

NEW YORK.

Security Issues Authorized. The Astoria Light, Heat & Power Company was authorized by the Commission of the First District to issue $5,000,000 in 5.5-per cent bonds and $9,500,000 in additional stock to take up notes given to the Consolidated Gas Company.

The New York Edison Company was given permission to issue $15,800,000 in additional capital stock.

The Pulaski Electric Light Company was granted the right by the Commission of the Second District to furnish electricity for light, heat and power in the town of Orwell, village of Altmar and town of Albion, Oswego County. The Commission also authorized the transfer of the franchises of the Salmon River Power Company to the Pulaski Company, permitting this latter company to construct and operate necessary equipment for transmitting electric power in and through the town of Richland, Oswego County.

Investigation of the Commission. The Department of Efficiency and Economy has begun an investigation upon complaints received relating to the failure of the Public Service Commission to reopen the case in which the Commission authorized the Canadian American Power Corporation to capitalize a contract with one of the Niagara power companies for the delivery of current.

OREGON.

The United States District Court for the District of Oregon has rendered a decision holding that the Commission has the power to require physical connection between two or more competing telephone lines. This decision upholds the order of the Commission providing for physical connection between the Pacific Telephone & Telegraph Company and the Home Telephone & Telegraph Company.

Standards of Utility Service. The Commission has under consideration the matter of adequate and serviceable standards of utility service involving the practices of all water, gas and electric utilities of the state.

PENNSYLVANIA.

Standards of Service. The Commission has issued a circular of rules and regulations for electric utilities prescribing the standard of accuracy of meters and rules for testing meters; standards of voltage regulation; and miscellaneous rules in regard to defective apparatus, maintenance and inspection, complaint records, and accident reports.

Issuing Rates on Less Than Statutory Notice. An order has been issued prescribing the manner and form to be used by public service companies in making application to the Commission for special permission to issue rates on less than statutory notice of thirty days.

WASHINGTON.

All Rates to be Published. The Commission has held that electric companies have not the legal right to furnish the state or any of its political subdivisions with electric current at rates other than those contained in the published tariff.

Annual Reports of Telephone Companies. The Commission has prepared forms for annual reports of telephone companies, and report blanks are being furnished to the companies doing business in the state.

WISCONSIN.

Security Issues of Electric Companies Authorized. The Commission authorized the Bark River Electric Light & Power Company to issue $12,000 of capital, $8,100 of which was to replace a similar amount of void stock issued previously without the sanction of the Commission. The certificate of authorization recites that the void stock had been issued for money only and that the proceeds had been used in making extensions and additions to the property of the company and for this reason the company was allowed to replace this stock by a lawful issue, it being evident that there was no intent to evade the statutory requirements. The remaining $3,900 of stock is to be issued for money only and the proceeds are to be used to pay indebtedness and to complete the construction of the company's plant.

A certificate of authority to issue $6,000 of stock was issued to the Coleman-Pound Light & Power Company. The company is to use the proceeds derived therefrom in the construction of an electric light and power plant and the necessary transmission and distribution system to supply the villages of Coleman and Pound with electrical energy.

Security Issues of Telephone Companies Authorized. The Ripon Telephone Company was authorized to issue $10,000 of capital stock.

The Dancy Telephone Company was authorized to issue $1,800 of capital stock, the proceeds of which are to be used in paying for past and future extensions.

The Ryan Farmer's Telephone Company was authorized to issue $150 of capital stock.

Proposed Changes in Kansas Utilities Law.

Some radical changes in the public utilities act of Kansas will be made, if the recommendations of a committee appointed a year ago by Governor Hodges are carried out. The committee, consisting of three men from each branch of the Kansas Legislature, met at Topeka on May 5 for the purpose of considering changes in the act. Chief of the recommendations probably will be one which will give the Public Utilities Commission far more power than it has enjoyed in the past. The committee is composed of J. D. Joseph, J. H. Stavely and Noah Bowman, from the Senate, and S. N. Brewster, William Barrett and F. H. Chase from the House of Representatives. Others who participated in the conference at Topeka were John M. Kinkel and James Cable, members of the present commission and Ernest Hogueland, secretary of a former commission. Mr. Kinkel believes that 80 per cent of the public utilities of Kansas are inefficiently managed and that the Public Utilities Commission should be permitted to change the management wherever it finds incompetency. A uniform classification of accounting was among the other recommendations discussed.

Congress to Consider Hydroelectric Project for Washington.

A bill for the development of electric power for use in the District of Columbia, from the Potomac River, has recently been introduced in the Senate by Senator Norris, of Nebraska, as an amendment to the River and Harbor Bill. This bill authorizes an ependiture of $15,021,600 for the construction of a 115-foot dam and hydroelectric plant at Chain Bridge, a short distance above the city of Washington. It is said that such a dam would create a lake nine miles long, reaching back to Great Falls, the present source of the city's water supply, and that this lake could be used as a source of city water supply.

About 99,000 horsepower, which would be more than sufficient for the needs of the government, is expected to be capable of being developed in this way. At the present time the government owns a steam plant capable of developing 10,000 horsepower of electrical energy. In addition to this energy the government obtains over 1,000 horsepower from the Potomac Electric Power Company at an average cost of 2.011 cents per kilowatt-hour. The estimated cost per kilowatt-hour, including interest on the sinking fund, for the generation of power from the Potomac River under these conditions is about 0.87 cent. This low cost of generation would enable the government to offer the railway systems and commercial users very attractive rates for at present all power is furnished from steam power plants.

The Importance of Careful Investigation of Wood Preservatives.

A matter which has been giving electric light and power companies, steam and electric railway properties, and telephone and telegraph plants some considerable concern is the matter of securing authoritative analyses and tests of so-called wood preservatives. A great many public utility corporations are utilizing wood preservatives in considerable amounts, but as there is no official test to which these preservatives might be subjected, there is considerable concern over the actual value of some compounds, the practical value of which can only be determined after years of service.

It has been suggested, therefore, by some of the largest users of wood preservatives, and the matter has been highly endorsed by one of the largest producers of wood preservatives in the country, that the buyer of wood preservatives secure from the seller the protection of package brands which will constitute in effect a true statement of what a preservative contains.

The specification required by the American Telephone & Telegraph Company's method of analysis now in force, and that also of the Western Electric Company, which is also the specification of the New York Dock Department, the United States Signal Service and the United States Navy, calls for the producer to make affidavit that, first, he is familiar with its analysis and with its method of production. The analysis further consists of establishing the specific gravity at 38 degrees Centigrade, the flashing point, burning point, distillate below 235 degrees Centigrade, distillate coming over between 235 degrees Centigrade and 300 degrees Centigrade, the pure liquid coal tar oil residue at and above 300 degrees Centigrade, the tar acids in the distillate below 300 degrees Centigrade by volume of the entire sample, the sulphonation residue, the constituents insoluble in benzol, the form at 38 degrees Centigrade, the ash left on ignition, and the statement that it is a true product of coal tar free from adulteration, and that it is not a by-product of petroleum, water-gas tar or oil tar.

Utah Electric Club.

At the regular weekly luncheon of the Utah Electric Club held at the Commercial Club, Thursday, May 7, Lieutenant W. B. Wallace of the U. S. Army read a paper on the subject, "The Regular Army in Times of Peace, and Provisions for Its Expansion in War Times." He pointed out how the regular army as constituted in times of peace is intended to serve only as a nucleus of the war army, and that it is the purpose of the Federal Government to educate and train the National Guard of the various states as the first reserve to the regulars in case war is declared.

The club had as its guests at the luncheon the senior engineering class of the University of Utah with their professors. During the luncheon remarks were made by Professors Knowlton and Beckstrand emphasizing upon the boys the advantage of contact with the men who are actually engaged in commercial pursuits during their course in school.

The Entertainment Committee announced the spring outing of the club to be held at Lehi, 30 miles south of Salt Lake City on the line of the new Orem Interurban Line, Saturday, May 16. The club will leave Salt Lake City at 1:30. There will be a baseball game at Lehi in the afternoon between a picked team from the Electric Club and the Lehi team, which won the championship in the Utah County league last year.

At the regular meeting of the Utah Electric Club, held at Salt Lake City, Utah, on April 30, President Torrence explained that the Electric Club had been invited by the Commercial Club of Salt Lake City to participate in a "whirlwind campaign" on that day, which had for its object the raising of a $40,000 publicity fund for Salt Lake City to be expended during 1914.

Ten of the principal clubs of the city had been invited to co-operate in this campaign, each agreeing to put in the field at least six teams of two men each. The Electric Club had responded heartily to the call of President Torrence for assistance, and seven teams were out working that had consisted of the following: H. F. Holland and W. D. Bowerman; F. H. Barber and H. T. Plumb; C. B. Hawley and B. W. Mendenhall; Lloyd Garrison and F. C. Reinhart; C. D. Kipp and R. S. Folland; A. E. Smith and F. Rouston; W. W. Torrence and Leo Brandenburger.

The committees had been at work all of that morning and were meeting with excellent results. It was freely predicted that the Electric Club would head the list of all of the ten clubs in the number and amount of subscriptions secured. When the final results of the day's work were checked up, however, it proved that the Ad Club had been assigned the banks of the city and had received one large contribution from all of the banks through the Clearing House Association, which threw the Electric Club in second place in the amount of subscription. The latter led by a large majority, however, in the number of subscriptions secured.

The speaker of the day at the weekly meeting was Lieutenant Cake, of the United States Navy, who took as his subject the armament and electrical equipment of a battleship.

Pittsburgh Section Meeting.

The regular monthly meeting of the Pittsburgh Section of the Illuminating Engineering Society, which embraces Cleveland in its territory, will be held in the latter city, Friday, May 22. It had been originally intended to have this meeting on Friday, May 15, but at the suggestion of the Cleveland members it was decided to postpone the meeting until the later date so that the members could visit the Cleveland Electrical Show which will be in progress at that time.

The Pittsburgh delegation will go to Cleveland in a special car and the meeting will be held in the early part of the evening, after which the Society will be the guests of the National Electric Lamp Association at the Nela Park Laboratory. The following papers will be presented at the meeting: "The Illumination of Building Exteriors," by Ward Harrison; "The Latest Development in Mazda Lamps," by C. L. Dows.

Annual Meeting of the National Fire Protection Association.

The eighteenth annual meeting of the National Fire Protection Association was held in the assembly room of the Insurance Exchange Building, Chicago, Ill., on May 5, 6 and 7. Following the roll call on the morning of Tuesday, May 5, President Robert D. Kohn, of New York City, delivered a short address in which he summarized the work that had been done during the past year. The report of the Executive Committee was next presented and a resolution passed to the effect that the Executive Committee should give manufacturers the opportunity to express their views on matters under consideration. This was followed by the reports of the secretary-treasurer and the editor of the quarterly. F. H. Wentworth, secretary-treasurer and editor of the quarterly, in presenting the latter report, recommended that the quarterly retain its technical nature and that bulletins be issued to disseminate the more popular material that is desired. Both reports were accepted and the editor's suggestion adopted. The report of the Committee on Amendments to the Articles of the Association was then presented by R. L. Humphrey, of Philadelphia, and the Association voted to make several changes in its constitution. These changes included the creation of the position of second vice-president, the creation of a nominating committee, and the broadening of the articles on membership so as to make federal, state and municipal departments, bureaus, etc., eligible for membership.

The remainder of the morning was devoted to the reports of the Canadian Committee, Public-Information Committee, and the Committee on State Fire Prevention Associations. In presenting the report of the Canadian Committee, Chairman J. B. Laidlaw called attention to the active, energetic and successful work that is being carried on in Canada. The reports of the other committees both emphasized the necessity for educating the public, fire marshals, and firemen in fire-protective methods. During the morning session an engraved invitation inviting the association to hold its next meeting in San Francisco during the Panama-Pacific Exposition was delivered.

The afternoon session opened with an address by Frank D. Chase, who spoke on the subject, "Adoption of N. F. P. A. Standards by State and Municipal Action." About 26 states now have fire-prevention bureaus and numerous cities have inspection bureaus, but there is a great need for reducing the number of standards and for interesting municipalities in fire protection. R. H. Campbell then gave a short talk on accident prevention. The remainder of the session was devoted to the reports of various committees, among which was that on Safes and Vaults, which was presented by H. W. Forester, chairman. This report, which was adopted, recommends that the current for vault lights be secured by a detachable cord which can connect an inside and outside receptacle when the door is open, and that wiring entering a vault near the floor be accepted. The report of the Committee on Laws and Ordinances was also presented. This included the wiring of motion-picture booths.

The morning session on Wednesday opened with R. L. Humphrey, of Philadelphia, in the chair. Following the reports of the Committees on Automobile Fire Apparatus and High-Pressure Fire-Service Systems, was an address by Fire Commissioner Robert Adamson, of New York City, on the subject, "Municipal Fire Prevention." Commissioner Adamson called attention to the general campaign which is being carried on in New York City for fire protection. At the present time frequent periodic inspections are made of all buildings, excepting residences, by uniformed men of the fire department.

William H. Merrill, manager of the Underwriters' Laboratories, then delivered an address entitled, "New Features in the Work of Underwriters' Laboratories." A laboratory has been in successful operation for more than a year in New York City, its work being confined almost exclusively to electrical testing. It is hoped, however, to broaden its work to include the same variety of testing as is done at the Chicago laboratories. An office has also been opened in London, England, for the inspection of English-made goods. However, a laboratory test of sample ware is, of itself, insufficient, and about 60 per cent of the laboratories' work is now done through inspectors stationed at branch offices and representatives in the field.

The morning session concluded with the report of the Committee on Fire Pumps, and the afternoon was spent at the Underwriters' Laboratories, where numerous tests were being made on rubber insulation, switches, electric signs and numerous tests on non-electrical apparatus such as wired-glass, sprinklers, fire-extinguishers, etc. Both the chemical and electrical laboratories in the new and old buildings were operated to their full capacity.

Thursday morning's session, during which F. J. T. Stewart and D. E. Waid, both of New York City, presided, opened with the report of the Committee on Controlling Equipments for Electric Fire Pumps. This report provides for the protection of the controlling equipment by grill or lattice partitions or sheet metal cabinets. Flame-proof wiring is specified as well as pilot lamps to show the presence of voltage on the line. Several other committee reports followed, among which was that of the Committee on Signaling Systems, which was presented by W. S. Boyd, of Chicago. Only a few changes were made in the rules adopted at the meeting in May, 1913. These changes provide for the insulation of starting levers from the mechanism and cases of starting boxes, and for the grounding of boxes. Mr. Boyd then presented the report of the Electrical Committee. This report recommends permission to be granted for the use of enclosed fuses in multiple when the capacity of a circuit is greater than that of the highest-capacity fuse made. Several other fuse problems were referred to a sub-committee which will report in March. A standard set of rules governing appeals between inspectors and contractors was adopted. The remainder of the morning session was devoted to the reports of the Committees on Fire-Protection Coverings for Window and Door Openings, Blower Systems, Fire Preventive Construction, and Standards.

The afternoon session, during which W. H. Merrill presided, opened with a report of the Committee on Field Practice. This report will be published at a later date as a guide for property owners, inspection offices, etc. Part of this report is devoted to electric-lighting and electric-power hazards. The National Electrical Code is recognized as the highest authority governing electrical installations, and rules are given regarding the care of apparatus and circuits and points which should be noticed during inspections. The reports of the Committees on Automatic Sprinklers, Fire Hose, Explosives and Combustibles, and Standard Hose Couplings and Hydrant Fittings were then presented.

The reports of delegates to conventions of other bodies were then presented, and were followed by the report of the Nominating Committee, which was appointed by the president, and the election of officers. The following officers were elected: President, R. D. Kohn, New York City; first vice-president, C. E. Meek, New York City; second vice-president, L. Wiederhold, Jr., Philadelphia; secretary-treasurer, F. H. Wentworth, Boston; executive committee, F. J. T. Stewart, New York City, chairman, and the following members for three years: S. W. Stratton, J. White, R. P. Miller, C. H. Patton and C. L. Scofield, and F. M. Drake for two years, and C. M. Goddard for one year; nominating committee, W. E. Mallalieu, D. E. Ward, C. H. Phinney and the two ex-presidents, W. H. Merrill and H. L. Phillips.

RELATION OF ELECTROMAGNETIC THEORY TO ELECTRICAL ENGINEERING.

Lectures by Professor Pupin Before the American Institute of Electrical Engineers.

Prof. Michael I. Pupin delivered two lectures to the American Institute of Electrical Engineers in New York City on the evenings of April 29 and May 6, the subject being "The Relation of the Electromagnetic Theory to the Science of Electrical Engineering of the Present Day." These lectures were arranged by the Committee on Technical Lectures, of which W. I. Slichter is chairman.

The lecturer was introduced by President C. O. Mailloux, who spoke of Professor Pupin's epoch-making work on loading coils for telephone lines and linked his name with that of Lord Kelvin as one who had distinguished himself by the solution of differential equations.

A synopsis of the first lecture follows.

I am going to present a discussion of the electromagnetic theory for the purpose of making it clear which part of this theory is of importance to the engineer and which part is of little importance to him but of great importance to the physicist.

Coulomb's experiment with the torsion balance in 1785 was the starting point of modern research along electrical lines. He discovered the existence of a force between two charged bodies which was proportional to the product of the charges and inversely proportional to the square of the distance between them. This law is one of the foundation pillars of the electromagnetic theory. It indicates the existence of a field of force surrounding every electrical charge which can be described by the statement that the force in any given direction is equal to the gradient in that direction of a function which is called the potential. It can easily be shown that the work done in moving any charge against the force produced by such an electrical field is equal to the product of the charge and the difference of potential existing between the two points. To move the charge against this force requires an expenditure of mechanical work and the question arises, what becomes of the energy so expended? We speak of it as energy stored and possessed by the charge due to its position, or potential energy. On the other hand, what becomes of the energy expended by the electrical forces when an electrical charge is set in motion by these forces and moves to a point of lower electrical potential? According to Newton's third law of motion you must always have two forces, usually spoken of as an action and a reaction, involved in every expenditure of energy or mechanical work.

In Coulomb's time this question as to what becomes of the energy when a charge moves to a point of lower potential could not be answered. In 1820, however, Oersted discovered that electricity in motion produces a magnetic field and that in consequence of the existence of that magnetic field electricity in motion has energy very similar to the kinetic energy of a moving mass. That gave the clue to the reaction above mentioned, which led to an answer to the question which was given by Maxwell.

Newton's third law of motion, involving action and reaction can be illustrated in the case of a closed network of electrical conductors and has been formulated as Kirchhoff's law that the sum of the electromotive forces in any closed circuit is equal to the sum of the reactions represented by the product of the current in each branch by the resistance of that branch. Kirchhoff's law is thus only a particular case of a more general relation which holds true in all cases, even in case of a circuit where you have mercury-vapor lamps, for example, where Ohm's law is not followed. The above applies to the motion of electrical charges with constant velocity, as inside of a conductor.

I will now discuss the case of the reaction experienced in the motion of an electric charge in a dielectric.

Faraday found a great aid in the study of electric phenomena to be a geometrical picture of an electric field occupied by lines of force. Coulomb's law would be represented in such a field by conical tubes, the variation of whose cross-section enables one to visualize the variation of force with distance. It is found convenient to draw $4\pi Q$ tubes of force emanating from a charge Q and this number of tubes will cut any surface surrounding the charge, the cross-section of each tube varying with its distance from the charge. If a portion of this charge is permitted to move off to infinity under the action of the electric force, work is done upon the portion of the charge which has moved away and the potential energy of the remaining charge has been lowered. The question as to what has become of this energy and where it is located was first answered by Maxwell. Maxwell pointed out that the medium through which the charge moves must react and the work which has been done is stored up in the medium. What is the form of that reaction? As a general proposition we do not know.

When a condenser is charged, energy is stored in it by the application of force. How the dielectric of the condenser reacts we do not know, but the work is not entirely reversible when the condenser is charged and discharged. The curves of charge and discharge are not identical and the loop between them represents work done, which appears as heat in the condenser. Similarly when a piece of iron is magnetized work is again done, which appears as heat in the iron. If the iron had constant permeability and no hysteresis, the work done in a complete cycle would be zero. Actually it is not zero, and a finite quantity of heat is produced. In a perfect dielectric no heat would be produced and the energy would be entirely returned when the condenser was discharged. In the mean time this energy must reside in the dielectric. Maxwell's great work was to locate in the dielectric the seat of this energy. It is also the seat of the magnetic energy which disappears in a similar manner when work is done by the separation of two magnets.

When these operations take place not in empty space or a vacuum, but in a material medium, the quantitative values are affected by numerical quantities which are designated as the specific inductive capacity and the magnetic permeability of the material.

According to Maxwell, then, not only ordinary ponderable substances like iron and dielectrics can act against an impressed magnetic or electrical force, but the vacuum itself can react. This was the great innovation introduced by Maxwell—the possibility of an action and a reaction between a force arising from a ponderable body and a surrounding space which is a vacuum.

In beginning the second lecture Professor Pupin summarized the main points of the previous lecture and then proceeded to develop the subject further. A synopsis of the second lecture follows.

The work of Ampere followed the discovery by Oersted that an electric current acts upon a magnetic needle and must therefore create a magnetic field. Ampere formulated a law according to which the magnetic flux of a current is distributed in space. That law can be expressed in various ways. Maxwell expressed it in a distinctive way for the purpose of bringing out its relations as formulated in his mathematical theory. If a closed line be drawn surrounding any current of electricity, the magnetomotive force in such a closed circuit is equal to 4π multiplied by the current. Other ways of expressing this relation are by the Biot-Savart law and by the equivalent magnetic shell.

The second great innovation which Maxwell introduced was the conception of regarding electric tubes of force as the equivalent of the electric charges Through any surface surrounding a charge Q there pass $4\pi Q$ tubes of force. Whenever the number of tubes of force passing through a surface varies, the rate of variation divided by 4π gives the current through that surface. There is consequently a magnetomotive force produced in space whenever a distribution of electric flux is varied. It does not matter whether the space is occupied by an electrical conductor or not; it does not matter whether there is an actual electrical current or merely an electric flux of force. With this idea in mind we can regard an electrical current as existing in a vacuum. This extension of the relations discovered by Oersted and Ampere to the notion of an electric current in a dielectric and in a vacuum in the sense of motion of tubes of force was Maxwell's second great contribution to the electromagnetic theory.

The final step in this theory is a logical sequence of this law and the law of Coulomb, although it took the genius of Faraday and Henry to discover it. If an electrical current, whether a conduction current, a displacement current or current of electric flux, produce a magnetic field and consequently stores magnetic energy in the surrounding space, what is responsible for this energy? What is responsible for the action and the reaction? An electrical current is produced by an electromotive force and consequently an electromotive

force is responsible for the magnetic energy. What reacts against this electromotive force and how does it react? Faraday discovered the reaction. Whenever the magnetic energy is varied there must be a variation in the magnetic flux and the rate of change of this magnetic flux through any circuit gives a reaction in the form of an electromotive force.

Maxwell introduced the extension of this idea that it does not make any difference whether the circuit considered is an actual conductor or not. The variation of the magnetic flux within any closed line produces an electromotive force in that circuit whether it be a conductor or dielectric. If there is a closed conducting circuit there will be a current, but in any case there is an electromotive force.

That is all there is to the electromagnetic theory, which may be summarized as made up of the following things: (1) Coulomb's law; (2) action and reaction in electrical circuits, particular cases of which are represented by Ohm's law and Kirchhoff's law; (3) electric and magnetic reactions in dielectric depending upon the electric flux and the magnetic flux; (4) Oersted and Ampere's law as extended by Maxwell—the rate of variation of the electrical flux linked with any curve is equal to the magnetomotive force around that curve; (5) the rate of variation of the magnetic flux linking any curve is equal to the electromotive force around that curve.

The general law in every case is that the sum of actions in a circuit is equal always to the sum of the reactions.

Only that part of the theory is useful in electrical engineering which relates to electrical conducting circuits. The part of the theory, however, which deals with the space surrounding electrical conductors has played a tremendous part in the electromagnetic theory of light. Reflection, refraction, polarization and other simple phenomena of light can be explained on the basis of this simple electromagnetic theory. Dispersion and magneto-optical phenomena present difficulties, however, and the equations representing the simple theory do not suffice to explain them. They must be modified for the case of high frequencies of variation, such as we have in the case of light, because the reaction of the dielectric in that case is not the same as for a slowly varying force, since molecular and atomic structure then come into play. It is consequently necessary to study the theory of electrons and the reactions of a charge freely moving at high velocity. He then referred to the work of Lorentz, Larmor, Roentgen, Perrin and J. J. Thomson.

The theory of Maxwell is extended by considering the moving electrical charge as equivalent to a current, since it has the same magnetic effects. He explained how the change of mass of an electron can be measured by deflecting it in magnetic and electric fields. It was found that the reacting mass of the moving electron not only depends upon its velocity, but that its mass is entirely electrical; that is, electrons have no gravitational mass at all.

The Michelson-Morley experiment was designed for the purpose of discovering whether the velocity of propagation of light is different for two sources whose positions with respect to the observer varied, in that the propagation in one case was parallel to the direction of motion through space and in the other case was perpendicular. No difference was discovered, which fact was explained by Lorentz and by Fitzgerald by the hypothesis that the length of the apparatus varied according to the direction of motion. On the other hand, Einstein advanced the theory of relativity to account for this phenomenon.

The study of electrons and the theory of their motions and actions does not at first seem very close to the electrical engineer, but modern developments make it incumbent upon him to become familiar with this material, since it is important in its relation to such subjects as corona, mercury-vapor rectifiers, action of the audion in wireless telegraphy, etc.

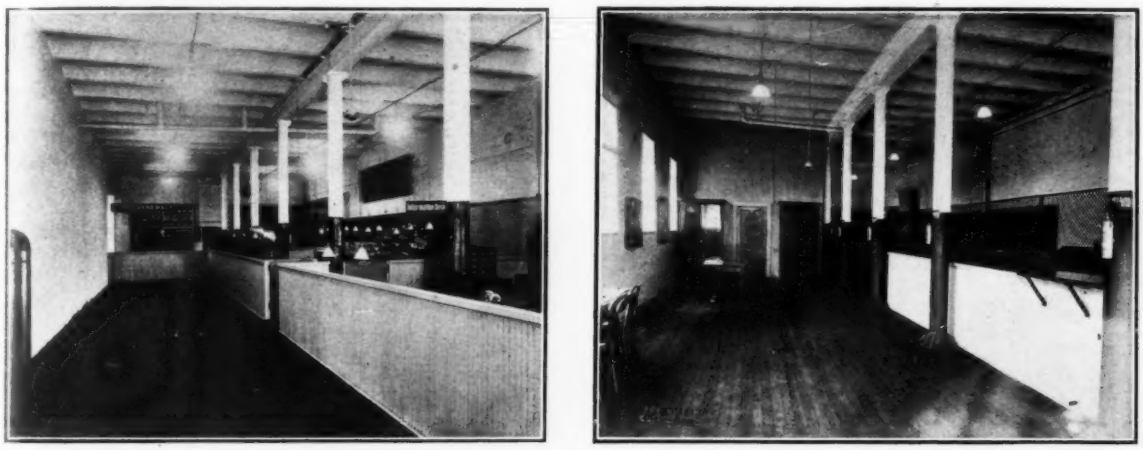
A New Wireless Record.

Officers of the Pacific Mail liner *Mongolia*, which reached San Francisco, Cal., recently from the Orient, announced that on the night of April 21 the ship's wireless operator picked up a message from Boston, 8,500 miles away. Several messages were exchanged. This is said to eclipse all previous distance records.

Conference of Ohio Metermen at Columbus.

A conference of the Meter Committee of the Ohio Electric Light Association was held in the rooms of the Meter and Distribution Department of the Columbus Railway, Power & Light Company, Columbus, O., on May 8. The meeting was attended by 41 men, representing 18 companies each possessing from 250 to 70,000 meters.

One of the encouraging features of the Ohio Electric Light Association work for 1914 is the large meetings that have been held by standing committees. It shows not only that the electric lighting men of the state are interested in advancing their work but they appreciate the fact that the Association is an agency which can be used for that purpose. This attitude was evidenced by the discussions that took place at this meeting and unquestionably much benefit was derived by those attending.



Two Views of New Meter Department of Columbus Railway Power & Light Company, where Conference Was Held.

The meeting was called to order shortly after one p. m., by Chairman A. H. Bryant, of the Cleveland Electric Illuminating Company, who spoke at some length relative to the general problems confronting the meterman. He stated that owing to the great diversity of work, some of the problems could not, at the present time at least, be solved. Some ideas which would be practical for one company could not be used by another on account of different existing conditions. Meter work has not yet reached the ideal stage as regards facilitation of work.

The early part of the meeting was taken up by all getting acquainted. Each representative was called upon to rise, give his name, the name of the company which he represented and the number of meters in his charge.

Following this, R. Wolford, representing the Ohio Light & Power Company, of Newark, presented an excellent paper outlining in detail the meth-

ods for testing meters at his plant. This was followed by an address by H. B. Bixler, of the Northern Ohio Traction & Light Company, of Akron, on "Meter Testing by Small Central Stations." It was pointed out by Mr. Bixler that an important factor in meter testing is the best meter standard with a convenient and quick way of checking its accuracy. A rotating standard with a range suitable for nearly all meters met with in practice can be obtained from the leading electric companies at very nominal cost. Its accuracy can be checked and maintained by taking the average accuracy of a lot of new meters, not including any one that might differ a few per cent from the others, or by maintaining what is known as a wall standard. Mr. Bixler stated in a very convincing manner that central-station companies lose considerable revenue by not making regular tests on their meters as in most cases tested if an error was found it was usually in favor of the customer. The policy of testing meters only on complaint should be discontinued.

After this paper there followed an open discussion on various questions pertinent to the work of metermen. The question of leaving meters on the line after an account was closed was taken up and discussed at some length, the general consensus of opinion being that meters should be left for a certain period. There were also brief discussions on the subjects of charging the consumer for setting a submeter, metering a welding installation, making calls on reading lockouts and policy of installing meters for charging plants.

Professor Caldwell, of the Electrical Engineering College of the Ohio State University, then gave a short talk in which he stated that his department was at all times at the disposal of the metermen and could render them aid in checking and calibrating at a very small expense and probably much quicker than the factories could do it. He stated that the engineering college was in close touch with the National Bureau of Standards in Washington, and during the summer months there were several men available who could be sent to the various stations if desired. In conclusion, he recommended that central-station companies get in closer touch with their customers and in this connection the relations of the meter department to consumers were decidedly important.

The meeting was then adjourned, after being pronounced one of the most successful of the meetings held this year. The two accompanying illustrations show the interior of the meter department of the Columbus Company, where the meeting was held. One of the illustrations shows the test racks.

Big Rejuvenation in Chicago.

The third rejuvenation of the Jovian Order held in Chicago during the administration of Statesman Homer E. Niesz was held at Hotel Sherman on Monday evening, May 11, and in many respects was the most successful function of its kind ever held in Chicago. The floor work was all of high order and elicited the hearty commendation of everyone present. Under the direction of George C. Richards, the Degree Team held several rehearsals and every member carried out his part in admirable manner. An innovation was the Pluto scene, representing a cave of fire from which Pluto appeared and disappeared as if by magic. The other electrical effects were also highly spectacular.

Although 96 applications were reported by Victor Tousley, chairman of the Membership Committee, preceding the ceremony, only 70 candidates were initiated, the missing ones being detained by the inclement weather and in many cases, for business reasons. Preceding the rejuvenation ceremonies, dinner was served and following the initiation a vaudeville bill of exceptional merit was provided.

At the regular noon-day meeting of the Chicago Jovian League, held May 26, C. D. Smith of the Willard Storage Battery Company, presented a very interesting paper entitled "Electric Light Plants in Mexico." Mr. Smith, who has spent considerable time in this district as a representative of electrical manufacturers, gave figures on the status of the electrical industry in Mexico, incidentally pointing out the deplorable conditions which exist in most localities in regard to the character of material used and the class of workmanship employed. There are great possibilities for hydroelectric development in Mexico, although at present the total capacity is but 130,000 kilowatts. The total mileage of transmission lines aggregates in the neighborhood of 900 and the greatest applications of electric power are in the mining districts. The rates for energy vary from one-half cent per kilowatt-hour in the mining districts to 40 cents per kilowatt-hour in some of the residential districts. Although there is a large amount of American apparatus in use there is practically an unlimited field for various apparatus and devices, particularly heating appliances.

Mr. Smith commented in a semi-humorous vein upon the wiring and construction work which existed in most localities. All interior wiring, he said, is done with twisted lamp cord and the cheapest of materials are used.

Following Mr. Smith, F. J. Blaschke, of the National Lamp Works, spoke briefly on the subject of "The Proper Lamp for the Circuit." His message to Jovians was to use every precaution to see that lamps and apparatus used on circuits were at least operated at the rated voltage of the circuit. He explained that exhaustive tests conducted by the engineering department of the National Lamp Works indicated that a great majority of the lamps and devices were operated at about four volts below rated voltage. This has been found to be largely due to faulty interior wiring and can only be remedied by the co-operation of all interested parties.

Louisville Jovians' Activities.

The Louisville (Ky.) Jovians, who organized several months ago, have dedicated the organization to serious purposes. Already there are 82 members, among whom is James Clark, Jr., of the electric manufacturing and supply company of the same name, who is Statesman. Robert Montgomery, manager of the commercial department of the Louisville Gas & Electric Company, is temporary chairman, and Fred V. Gantt, manager of the Louisville office of the General Electric Company, is temporary secretary. The plan heretofore followed consisted of holding fortnightly, noon-day meetings at local hotels, the last, Monday, May 11, having been held at the Henry Watterson Hotel. It is the plan, as soon as the club is thoroughly organized, to institute a membership campaign. It is estimated that there are nearly 400 eligibles in Louisville, and the founders of the local club announce that they are not going to stop until all are enrolled. One feature of the membership will be that it will not be limited strictly to electrical men. One of the first applications from men outside the business was that of Hugh D. Odom, manager of the Louisville Hotel and the Old Inn. In the future the Jovians plan to hold weekly noon-day meetings with luncheon to last an hour. These will be supplemented by other meetings, at which speakers will be heard and entertainment features provided. A committee has been named to look into the advisability of organizing a baseball team this summer. The Entertainment Committee has the various programs in charge and has been instructed to work largely along educational lines.

Philadelphia Jovian League.

At the weekly luncheon held by the Philadelphia Jovian League in the Bingham House, Philadelphia, Pa., on May 2, one of the speakers was William Draper Lewis, dean of the Law School of the University of Pennsylvania, who warned the members against politicians who seek office by promising to devote their time and efforts to dissolving monopolies. Dean Lewis showed that some monopolies were a help to the people and that not all were injurious.

BOOK REVIEWS.

"Les Surtensions Dans les Distributions d'Energie Electrique et les Moyens d'en Prévenir les Inconvénients." By I. van Dam. Amsterdam: Van Mantgem & De Does. Heavy paper, 273 pages (10x6½ inches), 109 illustrations. Supplied by the Electrical Review Publishing Company, Inc., for $2.40.

Much has been written during the last few years on the subject of extra high voltages and abnormal pressure rises; but the practical engineer, looking for information in connection with a particular problem, cannot readily refer to the literature that might be helpful to him, because it is scattered through a vast number of separate publications. If Mr. van Dam's book had no other merit than that of providing an up-to-date résumé of the most important questions relating to the causes of abnormal pressures and the means of guarding against their ill effects, it would be of great value to the electrical engineer. But this book is far more than a mere compilation; it is written by an engineer thoroughly familiar with his subject, and therefore able to discriminate between essentials and non-essentials, thus presenting in a volume of moderate dimensions the material most likely to be of use to engineers. The author has always the practical end in mind, and although a few of the chapters must necessarily deal with theoretical consideration, the treatment of such chapters is clear and simple. With the patient study and thoroughness characteristic of the best Continental writers, the author has given in the form of foot notes, references to the most important sources of information wherein the reader may follow up any particular line of investigation. This method, by which a writer applies his judgment and experience in helping the reader to the deeper study of a particular subject, is far more helpful to the busy man with little time to waste on fruitless reading than the method sometimes adopted of providing under the heading "bibliography" a more or less complete list of the publications relating to the subject treated. Another commendable feature of this book is the inclusions—in small type—of brief descriptions and leading particulars of such power plants or systems as may be referred to in connection with the working of protective apparatus, or for other reasons. There are 13 chapters covering the whole subject, in the following order: Disruptive Potentials (in air); the Corona Phenomenon; High-tension Insulators; Inductance and Capacity of Overhead Lines and Underground Cables; Higher Harmonics in Alternator Electromotiveforce Waves; Resonance; Open-circuit Pressure Rises on Long Transmission Lines; Pressure Rises due to Switching Operations, etc.; Pressure Rises due to Atmospheric Electricity; Lightning Arresters; Methods of Grounding; Protection against Contact between High and Low-tension Lines; Factors of Safety for High-tension Work, as used in France, Germany, America, and England.

Space does not allow of a detailed discussion of the several features of this book; but in the reviewer's opinion it is exactly what it claims to be—a summary of our present knowledge and an introduction to more detailed or specific study; the author has the unusual faculty of saying what is necessary without saying too much. To the American reader, this book is particularly to be recommended; because, although American practice and experience receive their due share of attention, yet the Continental methods are given more prominence than they usually receive in the technical literature published in this country.

On page 148, the effects of an intermittent ground are considered and if further editions of his book are called for, the author will no doubt refer to the arcing-ground suppresser as proposed by Mr. E. E. F. Creighton[1] since, if automatic devices have to be used, this particular one appears to have many points in its favor. A. STILL.

"Electric Arc Phenomena." By Ewald Rasch. Translated from the German by K. Tornberg. New York: D. Van Nostrand Company. Cloth, xvi+194 pages (5½x8 inches), 52 illustrations. Supplied by the Electrical Review Publishing Company, Inc., for $2.00.

Having as its chief purpose the discussion of the arc as a producer of light, this book does not deal to any considerable extent with the practical side of arc lighting. On the other hand, a fairly full account is given of the physical and theoretical aspects of the arc. The author's main thesis is that the light of the future is to be found in the arc between certain oxides—the "electrolytic arc," as he calls it.

Two of the chapters consist of a collection of extracts from the theory of electricity in gases and of spark discharges. The bearing of this discussion on the subject in hand is not always clear, so that these chapters leave a somewhat vague and unsatisfactory impression. At times a confusion is apparent as to the distinction between glow, spark, and arc discharges. On the other hand, the last three chapters contain much that is valuable on the voltage, current, and energy conditions in the arc, and on the efficiency of various types of arc. The diagrams are excellent. If the wild speculations of the closing pages, however, are ever realized, there will not be left much to electrical engineering but the study of the electric arc! In this adherence to what he considers the spirit of the electron theory, the author shows a curious tendency to disparage, in rather extravagant language, the work of Maxwell.

In the main, the work of translating is well done, although the English sometimes limps a little. Occasionally, it must be admitted, the translation quite fails to give the sense of the original. Pages 89, 97, and 177 contain conspicuous instances of this. Such incorrect forms as "discontinuance" for discontinuity, "disgregation," "limit value," and "anomal dispersion" may possibly be misprints. The equations on p. 41, dealing with what the translator calls "Neumann-Kopp's Law," contain several mistakes. The exponent —1 should be inserted after the word "Amps" in Fig. 30, and in Fig. 36, "supply" should be substituted for "external."

The book will doubtless prove of value to those who are interested in the physical problems connected with the electric arc. W. G. CADY.

"Electrician's Wiring Manual." By Frank F. Sengstock. Chicago: Popular Electricity Publishing Company. Flexible leatherette, 406 pages (4½x6½ inches), 414 illustrations. Supplied by the Electrical Review Publishing Company, Inc., for $1.50.

This book is a handbook of practical information on electric light, power and wireless installations installed in accordance with the requirements of the National Electrical Code, and should prove of value to not only the apprenticed wireman, but to experienced contractors as well. In addition to describing the various tools, fittings and methods of wiring for different purposes, this book also gives detailed explanation of the requirements of the National Electrical Code. One section gives considerable information on estimating and specifications, which will be found valuable by contractors. Many tables and formulas are included and simple explanations of the various systems of distribution in common use are given. One chapter is devoted to a simple explanation of alternating-current generators and distribution systems, several elementary formulas being given, while another chapter is devoted to a practical discussion of the care and operation of storage batteries. 45 pages are devoted to practical wiring kinks, which should be of great value to wiremen, as they contain many useful suggestions.

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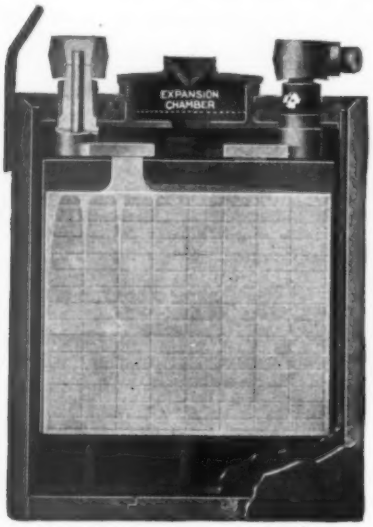
1 Protection of Electric Transmission Lines; *Proceedings American Institute Electrical Engineers.* Vol. XXX, p. 377.

New Electrical and Mechanical Appliances

A New Series of Gould Starting, Lighting and Ignition Batteries.

An improved line of storage batteries for starting, lighting and ignition of gasoline automobiles is now being marketed by the Gould Storage Battery Company, 30 East Forty-second Street, New York City.

The grids of these batteries are of the well known Gould type assuring high conductivity and low internal resistance throughout the life of the plate. The active material in the positive plate is harder than ordinarily used, and in service wears evenly, the result being uniform capacity throughout exceptionally long



Section Through Gould Storage Cell.

plate life. The maintenance of this uniform or normal capacity throughout the battery life is very desirable, as it permits safe use of a battery having capacity much nearer to actual requirements and one consequently smaller and lighter than where the plates get weaker with age.

A large settling chamber at the bottom of each jar permits long service without cleaning. Short-circuits between the plates are prevented by wide separation and rugged separators. Perhaps the most appreciated feature of these batteries is the neat cover arrangement, which is said to prevent leakage of electrolyte absolutely, permitting easy thorough internal inspection, and admitting of removal of plates, if necessary.

Each cell is closed by two hard-rubber covers and an intermediate layer of sealing compound in adhesive contact with the jar. Where the pillar posts come through the cover, sleeves of corrugated rubber and surrounded with the sealing compound make air and leak-tight joints of sufficient flexibility to allow for strains on the posts.

A very large expansion chamber with a threaded cap is provided for inspection and equalization of acid. Leakage up around the outside of this chamber is impossible as the chamber is made integral with the lower hard-rubber cover. Slopping over from the inside is prevented by making the cap an inverted cone. The spray condenses, drains to the point of the cone and drops back into the acid space.

Gould Six-Volt Starting Battery.

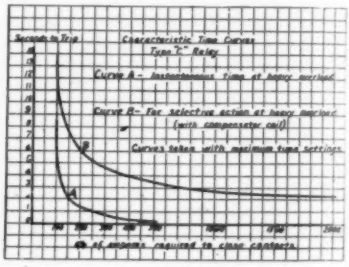
Removal of the vent cap, by twisting between fingers and thumb, exposes the entire chamber and admits enough light to make real inspection possible. With this construction and the acid level carried up in the chamber, gassing may be easily detected. A straight channel to the electrolyte allows the insertion of a hydrometer syringe to a sufficient depth for satisfactory test. The vent cap also provides a natural funnel for filling in water or acid without slopping or overflow.

These batteries may be had with an original end-to-end arrangement of the cells. This type promises to become popular, especially because of the short connectors and the small thickness (only 4.5 inches in the largest size). The latter permits the battery to be suspended from the frame and concealed back of the apron, instead of being put in front on the running board.

In addition to these features the general construction has been given great care. The pillar posts are copper-reinforced and copper connectors imbedded in lead are used between the cells to avoid connection resistance. The box, dimensioned to the standard recently adopted by the Society of Automobile Engineers, is made of thoroughly seasoned material, has interlocked corners and is coated inside and out with acidproof paint.

Torque Compensators.

The Westinghouse Electric & Manufacturing Company has introduced a new device, known as a torque compensator, intended primarily for modifying the time-element characteristics of an alternating-current overload re-


Characteristic Time Curves
Type "C" Relay
Curve A – Instantaneous trips at heavy overload
Curve B – For selective action at heavy overload
(with compensator coil)
Curves taken with maximum time settings

Time Curves of Relay.

lay. It reduces the torque of the relay at heavy overloads without reducing the torque at light loads. It thus increases the time element of the relay at overloads, its effect being in proportion to the overload.

An example of the effect of the torque compensator on the time-element characteristic of a relay is shown in the accompanying curves. Curve *A* shows the natural characteristic of the Westinghouse type C relay, which was described on page 948 of our last week's issue (May 9). When used with the torque compensator, a definite minimum time element at heavy loads is obtained, as shown in curve *B*.

The overload relay with definite minimum time element obtained by a torque compensator provides selective action of circuit-breakers where feeders are placed in series. The relays controlling breakers nearest the source of power can be set for slightly greater

time element than those further along. The difference in time is retained at all overloads with sufficient accuracy to cause the breakers nearest the trouble to open, thus confining the inoperative section to the smallest area, without interruption of service on part of the system between the trouble section and the source of power.

Another use of the relay with definite minimum time element is in relieving circuit-breakers. It is well known that the ultimate breaking capacity of a circuit-breaker depends on the time of breaking. If a ground or short-circuit can persist for two seconds before the circuit is opened, the ultimate breaking capacity is greatly increased; that is, the strain on the breaker is reduced very materially, owing to the drop in voltage and current occuring during the interval.

The torque compensator consists essentially of a small autotransformer connected between the relay and the current transformer on the line. It is so designed that at a certain value of

Torque Compensator.

current the core of the compensator becomes saturated and any further rise in current results in an increasing impedance drop so that the current in the relay circuit does not increase in proportion to the current in the line.

The ordinary time adjustment provided on standard relays will give the desired definite minimum time element within the range characteristic to each relay. In the Westinghouse relay this range is from zero to 2 seconds.

The winding and core are inclosed in a neat iron box with sides perforated for ventilation. The compensator can be mounted on any convenient place, such as the rear of a switchboard behind the relay it controls.

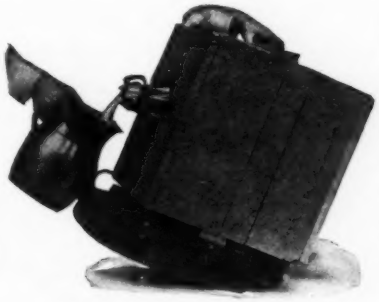
Combined Carboy Truck and Rocker.

The improved carboy rocker manufactured by the Munning-Loeb Company, of Matawan, N. J., combines the advantages of the hand truck and carboy rocker. This device is of great utility in the handling and pouring of acids and other chemicals or liquids from carboys.

The rocker is built of wood, and equipped with castor wheels. With this rocker one man can easily load and move a full carboy to any desired place and entirely empty it from the first to the last jugful without spattering a drop on his hands, face, clothes

Applying Truck and Rocker to Carboy.

or floor. The castor wheels make it easy to move the heavy carboys around the plant without lifting them on or off hand trucks, with attendant danger of breaking. The rocker can be attached to a carboy or changed from one carboy to another in less than half a minute. The illustrations herewith make clear the construction of the device, its attachment to the carboy and its use. A vent tube used in connection with the rocker makes the flow of liquid from the carboy uniform and



Tilting Carboy to Start Flow.

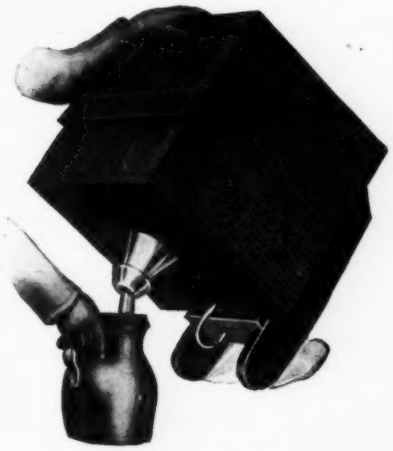
free from bubbles and spattering. The rocker weighs 11 pounds.

Electric Monorail Line for Cuba.

The Cameron Engineering Company, of Washington, N. J., has been awarded a contract for a monorail system to be erected in Cuba by a Cuban firm. The line will be electrically operated from trolleys.

Clipper Belt Lacer Company Has Good Profit-Sharing Scheme.

The Clipper Belt Lacer Company, of Grand Rapids, Mich., which inaugurated a profit-sharing scheme in 1913, has found that the plan has worked out to the advantage of both the company and the employees. It was decided to inaugurate the piecework plan wherever practical, and to assure the employees that the piece rate would not be lowered as their earning capacity increased. The working day was reduced to nine hours with a Saturday half holiday, no reduction being made in wages, and a bonus varying from five to 10 per cent of the year's wages was promised each employee depending upon the number of years in the company's service, the lower rate being granted to employees in the company's employ for one year. At the end of the year it was found that the yearly output



Emptying Carboy Easily.

had nearly doubled with only a slight increase in the working force. The average gain to operatives was about 19 per cent and the average direct gain to the company nearly nine per cent. As a result the company has obtained the hearty co-operation and good will of the operatives.

Pittsburgh Transformer Company Makes Recovery After Fire.

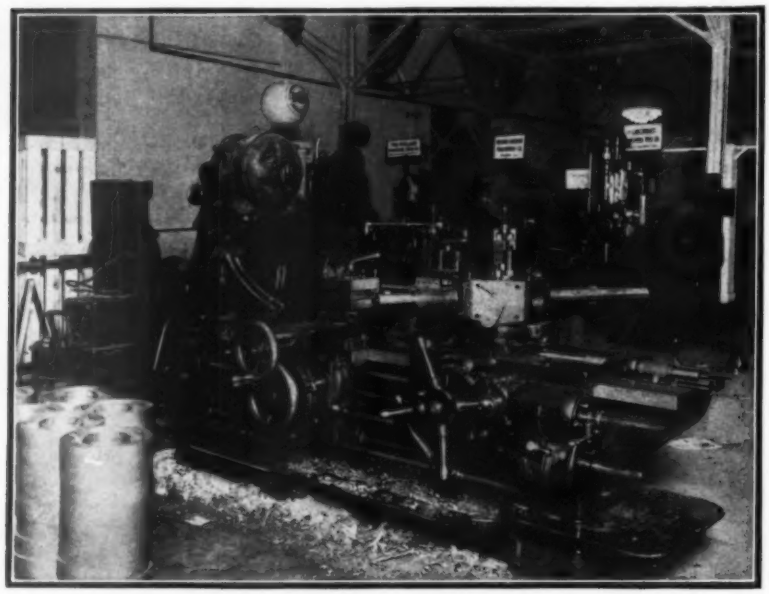
Fire broke out on May 2 at the plant of the Pittsburgh Transformer Company, Pittsburgh, Pa., doing some damage to the shipping department, store rooms, carpenter shop and tank factory. The loss is estimated at about $50,000. But few of the company's records and none of the drawings or designs were destroyed and there will, therefore, be no delay or inconvenience to any of the company's customers. A new shipping room was established on May 4, and shipments have been made every day since.

Motor-Driven High-Speed Lathe.

The motor-driven lathe shown in the illustration herewith was exhibited at the recent Foundry and Machine Exposition at Chicago, and was shown working on drop-forged gear blanks, 8.5 inches in diameter. The following results were obtained many times:

Rough and finish boring.....5.5 minutes
Rough and finish turning and facing on rim and hub.....2 minutes

The total time was 7.5 minutes for a job that is generally admitted to be a good hour's work for an engine lathe.



High-Speed Libby Turret Lathe.

This lathe is an 18-inch Libbey turret lathe manufactured by the International Machine Tool Company, Indianapolis, Ind. Its manufacturer claims that its rapid production is due to the great power developed, the strength and stiffness of all parts, and the convenience of operation. The entire operative control of the machine is concentrated for the operator and is so designed that the actual manual labor required of him is reduced to a minimum and he is offered every inducement to push the machine to its capacity.

It is driven by a Westinghouse alternating-current constant-speed motor. The speed changes are effected through a sliding pinion and two double frictions so arranged that the operator can stop his machine in the midst of a heavy cut and pick it up instantly under feed. Eight steps are provided, giving speeds ranging from 8 to 300 revolutions per minute.

New Clutch for Starting Motors.

A unique type of dog clutch has been developed by the Ward Leonard Electric Company, Bronxville, N. Y., for use in the gear box between the electric starting motor and the crank shaft or flywheel of gasoline automobile engines.

This clutch consists of two parts, one of which is pinned to the shaft which drives the crank shaft through silent chain, or which is pinned to the shaft on which there is a silding pinion which meshes with the flywheel.

The second part consists of a gear ring driven by the electric motor. This latter is mounted on its own bearings. This bearing is mounted concentric with the shaft on which the first member is pinned, and is big enough in diameter so this shaft revolves inside without any friction.

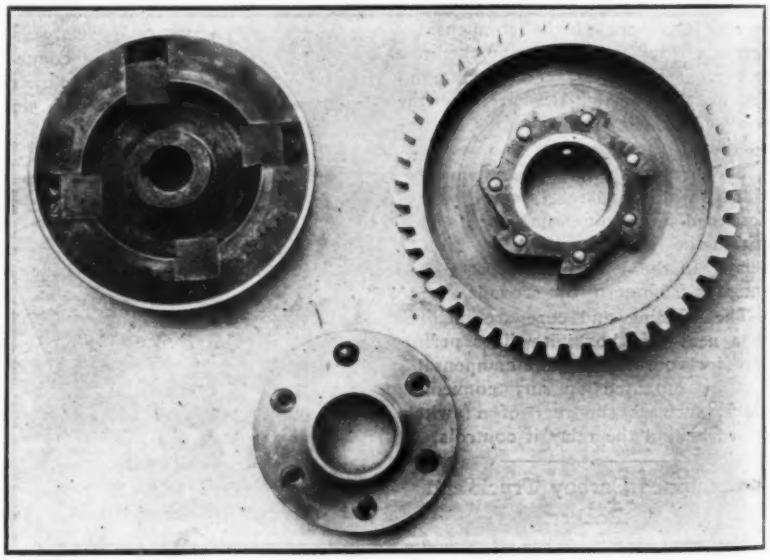
In the first member there are four blocks or dogs, spring-pressed inward, so that when the first member is mounted on the shaft, and the second member is on its bearings, these dogs are spring-pressed to engage with a series of notches cut on a cam in the second member. It will be noted that there are four dogs and seven notches. As a result only one dog will engage at a time, but one-twenty-eighth of a revolution will insure one engaging.

When these dogs are spring-pressed and engaged with the cam, the electric motor drives through the gear ring to the second member, thence through the cam and dogs to the first member, thence through the shaft to its sprocket, and then through the chain to the crank shaft.

When the crank shaft starts up the first member will tend to revolve faster than the second member. The inclined surfaces of the cam of the second member push the dogs out into the pockets provided for them and centrifugal force will keep them in that position at speeds of over 100 revolutions per minute of the gasoline engine.

It will be noted that when the engine is running and the electric motor has stopped, the second member is stationary on its bearing, while the first member has its dogs in the extreme external position and is being revolved on its shaft. As a result there is no wear when the clutch is not holding or when it is holding.

The manufacturers of this clutch claim for it a number of advantages, among which are the following: There can be no wear in running. A lack of oil can have no effect other than the possible freezing of the gear member to its bearing, and while this will keep the electric motor from starting the engine, it will not in any way affect the dynamo. Before this outfit can be made inoperative all four of the dogs must be jammed or lost, as only one of these engages at a time and each has ample strength to do all



Clutch for Connecting Electric Starting Motor to Engine.

the work. As a result of the number of dogs and the number of cam jaws, the motor cannot drive the gear member more than one-twenty-eighth of a revolution before it engages. A lack of lubrication cannot put the outfit out of business. It is noiseless when running, because there are no rubbing parts. Centrifugal force is not relied on to pull out the dogs; these are mechanically pushed out by the cam of the gear member and centrifugal force holds them out. If for any reason they are not held out by centrifugal force, no harm will be done as they will then be acting as a ratchet and a slight clicking sound will be the only result.

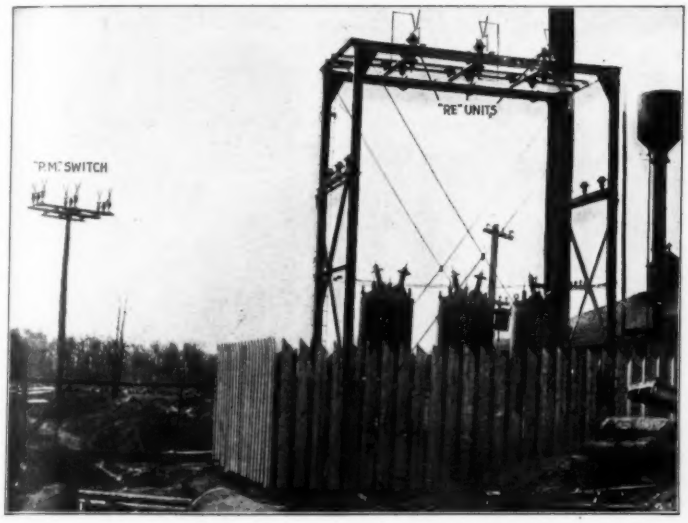
Outdoor Substations for Coal Mines.

The supplying of central-station power to coal mines is now making rapid progress especially in those districts traversed by high-tension feeders. The advantages of electric operation are well known, since mines have to be located where there is coal and the shafts put down at points required by mining conditions. This means that steam-driven plants are often at a disadvantage, owing to the poor water supply and the necessity of installing water-softening equipment, and the entire situation is materially bettered by electric operation. Central stations can, as a rule, supply power at more advantageous terms than it can be generated by the user and coal operators are rapidly realizing this fact.

The steel-tower high-tension outdoor substation is particularly well suited to this class of service, especially when safety and low operating costs are essential. The use of indoor or underground substations materially increases the fire hazard and also the factor of safety, as the insulation is rapidly weakened by moisture and corrosion. After a period of operation it may also be found necessary to relocate the substation and in such cases the steel-tower equipment has the advantage of high salvage values, the only loss being in the foundation and cost of erection.

A type of station designed by W. F. Corl, electrical engineer for the Allen & Garcia Company, Chicago, is illustrated herewith and has the advantage of low cost combined with reliability. The transformers and protective equipment are mounted on a substantial steel structure provided with ladders for ready access to the various units. The three-phase air-break switch is mounted on a separate pole.

The installation has an initial capacity of 300 kilowatts and can be increased to 1,000 kilowatts as the load develops. The transformers are of the Allis-Chalmers type, stepping down from 33,000 to 2,200 volts, and the switching and protective equipment was supplied by the Delta-Star Electric Company, Chicago, Ill.



Steel-Tower Substation for a Coal Mine.

Illumination of Scribner's Book Store.

The remarkable illumination produced in Scribner's new store on Fifth Avenue, New York, N. Y., is an excellent example of what can be done through the proper application of laws governing scientific illumination. The arched ceiling, which forms the principal architectural feature of this store, is of a soft cream white color, and is embellished with a series of simple but rich panel designs. The surface of these arches forms one of the most perfect light-reflecting mediums possible to obtain in architectural construction.

At the base of each arch is installed a powerful reflector that throws a strong white light upward. This light spreads over walls and ceiling and is reflected downward, diffusing a mellow glow of almost pure white light over the innumerable tables, shelves and cabinets filled with many colored volumes. The light produced by this system is substantially a reproduction of daylight, with the result that the finest details are plainly visible, while the most delicate colors can be seen in practically their true values. This is particularly noticeable when inspecting some of the rare old volumes found in the store.

The illuminating scheme of this beautiful store is finished with a series of elaborate semi-indirect lamps that hang from the ceiling on chain drops at a distance of about 15 or 20 feet apart.

The lamps used at the base of the arches for the indirect or cove lighting are J-M Linolite lamps. They are about a foot long and an inch in diameter, and have a straight tungsten filament that runs from end to end. This filament produces a continuous "line of light" that diffuses the illumination evenly over the entire surface to be lighted, in marked contrast to the spotty effect produced by the bulb type of lamp. These lamps are highly efficient.

Illumination of Scribner's Book Store.

The manufacturer of these lamps, the H. W. Johns-Manville Company, New York City, claims that more than 90 per cent of all the art galleries in this country, together with 25,000 churches and over 30,000 stores, are equipped with Linolite lamps in conjunction with Frink reflectors, for which this company is sole selling agent.

Electric Representation of Human Functions.

The use of electricity to perfect the representation of human functions is employed at Madame Tussaud's Wax

works, the famous exhibition of celebrities in London, England. The wax figure of a sleeping woman is given a realistic effect by the lifelike raising and lowering of the chest, as if in deep slumber, which is accomplished by the use of a small electric motor working through reduction gears and operating an eccentric which slowly produces the required motion. Another figure, this one seated, is made to turn from side to side slowly by a mechanism operated by the same motor, which is installed under the couch of the sleeping figure.

The current for the lighting and use of the motors in the exhibition is generated by a private plant on the premises.

Arc-Welding Equipment.

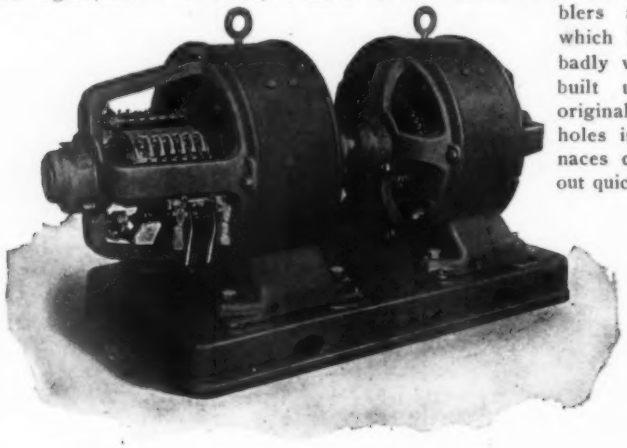
The subject of arc welding is receiving a great deal of consideration at the present time by railways and industrial concerns because of the many advantages it possesses for certain kinds of work.

Arc welding is particularly adapted for use in machine shops and foundries. Worn parts of machines can be built up prior to machining. Broken parts of steel castings can be welded together. Often defects develop in new castings, after considerable machining has been done. The machining and castings, in many cases, can be saved by repairing with the electric arc. Castings with blowholes and sandholes can often be very quickly repaired. Risers and sinkheads can be cut off.

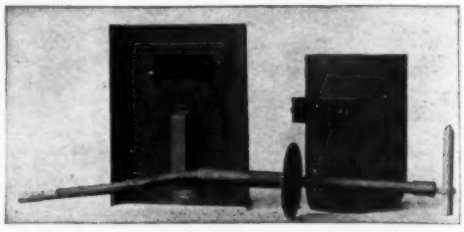
In steam-locomotive shops metal pencil welding is used extensively in fire box and boiler repairs, flue welding, repairing steel locomotive frames, building up mud rings and general work of this character. A large amount of equipment that would have to be scrapped can thus be repaired with the electric arc, and a large saving in money, time and labor effected.

In electric-railway shops arc welding can be used to special advantage in repairing broken armature shafts, axle brackets and motor frames. In track equipment, the repair of broken frogs, cross-overs and other work of this nature can be done with excellent results.

In steel mills, there are many places where the electric arc can be used to great advantage, often resulting in a considerable saving. The ends of wobblers and pinions, which have become badly worn, can be built up to their original size. Tap holes in blast furnaces can be burnt out quickly.



Motor-Generator Set for Arc Welding.



Welding Shield, Hood and Carbon Holder.

Realizing from past experience the practical value of the electric arc for general welding purposes, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a standard line of electric arc-welding equipments.

Making an Arc Weld on a Steel Ring.

The equipments comprise standard apparatus. They are simple in construction and easy to operate. Complicated relay schemes for automatically inserting resistances are eliminated. Ample protection is secured by circuit-breakers and special arrangement of the resistance. The outfits are furnished complete in the four following sizes: 200, 300, 500 and 800 amperes. Each equipment includes a welding generator, or a welding motor-generator set, switchboard, control and all necessary accessories.

The welding generator consists of a special 75-volt, commutating-pole, direct-current machine, either belt or motor-driven. The instrument and control panels are composed of two sections. The upper section contains the indicating instruments, protective apparatus and switches arranged for regulating the welding current, and the lower section contains the starting and protective equipment for the motor-generator set. It is often desired to have several welding circuits connected to one generator. For this arrangement a control panel is provided for each circuit. Each panel can be located at the most desirable place. Metal or carbon-pencil welding can be done from any of these panels, independent of all others, and one or more arcs can be operated simultaneously.

The accessories furnished consist of a carbon holder and a hood for protecting the operator, together with a shield and a metal-pencil holder for each welding circuit.

The equipment described above is the result of eight years' experience in its own shops by the Westinghouse Company, and has been employed on all classes of commercial work, thus ensuring a thoroughly practical shop outfit.

An Electric Furnace Heated Simultaneously by Arc and Current.

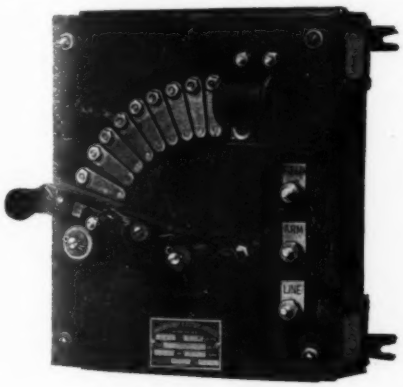
In a recent issue of *Zeitschrift fur Angewandte Chemie* is an account of an electric furnace heated simultaneously by arc and resistance. The current enters the furnace by a positive electrode suspended in a central position above the crucible containing the material to be melted; the arc is formed between the electrode and the crucible, the current escaping by a number of negative electrodes dis-

posed in the side walls of the furnace. These electrodes form two series, one above the other; the upper series is at the level of the material in the crucible, and the lower is formed of elements united by means of a piece of iron fitting into grooves in the bottom. The latter start the fusion of the metal or other material, while the former serve to refine it. The positive electrode can be moved up and down in such a way as to co-operate with either the upper or the lower series of negative electrodes.

New Resistance Casing for Starting Rheostats.

The Independent Electric Manufacturing Company, of Milwaukee, Wis., has developed and is placing on the market a new type of resistance casing for starting rheostats and controllers.

The casing or the resistance box itself, in which the resistance units are



New Casing for Rheostats.

mounted, is of cast iron, and in the sides of the box, at the top and the bottom, there are four large ventilating openings. These openings are covered with heavy noncorroding screens of fine mesh which allow free passage of air into the box, and positively prevent any sparks or flames emanating from the box in case of a burnout of the units, the principle being the same as on the safety lamps, which have been employed successfully for years in the mining industry.

There are no external openings whatever in the bottom plate of the box so that should a burnout occur, the molten parts dropping to the bottom of the box are absolutely prevented from falling to the floor. This box has been examined and approved by the Underwriter's Laboratories.

New Motor-Driven Tire Pump.

A new type of motor-driven automobile-tire pump for private garages has been perfected by the Hartford Machine Screw Company, Hartford, Conn. It is called the Master garage pump and is of simple design and construction. Its use dispenses with the tiresome hand pump and makes possible keeping the tires pumped full to the right pressure to insure the proper resiliency and service; this serves to keep down tire expenses. The pump has no rubber or leather packing rings and delivers pure air, free from oil. No large storage tank is required. All that it is necessary to do is to attach the end of the hose to the tire valve, turn on the switch, and then turn it off when the gauge shows that the tire is properly inflated. The pump will completely inflate a 37 by 5-inch tire to 90 pounds pressure in less than three minutes.

Master Garage Tire Pump.

The equipment consists of a two-cylinder pump driven by a small General Electric motor, all being compactly mounted on a frame; 20 feet of reinforced-rubber air hose with pressure gauge attached and 20 feet of lamp cord with plug are furnished.

Disk-Stove Chafing-Dish Set.

A novel arrangement of a combination disk stove and chafing dish has recently made its appearance. The set is similar to the ordinary alcohol-type chafing dish except that it has an electric disk stove, in direct contact with the water pan, instead of an alcohol heater. The complete set consists of a stand, a disk stove, cord, three-heat switch, and attachment plug, a water pan, a food pan, and a cover, as illustrated in Fig. 1. The water pan, the food pan and the cover are the same as used in alcohol chafing dishes.

All metal parts, except the top of the disk stove, are handsomely finished in polished nickel or polished copper. The handles are ebonized wood.

The heater of the disk stove consists of a steel disk inside of which the heating element is sealed and protected from oxidation. A dead-air space between the heater and the bottom of the stove casing acts as a heat insulator, preventing the loss of heat downwards, so that practically all of the heat is thrown upwards where it is wanted, making the stove very efficient.

An indicating switch controls the temperature. The high heat is ordinarily used to bring the chafing dish to the desired temperature. The low heat will keep water boiling after the boiling point is once reached and is useful for keeping food warm. The medium heat is the highest that is usually wanted for general cooking purposes.

Fig. 1.—Separate Parts of the Disk-Stove Chafing-Dish Set.

With the feet of the disk stove reversed so that the stove can be suspended from the stand and with the parts assembled as in Fig. 2, the outfit is a chafing dish, capable of cooking anything in it that can be cooked in an alcohol chafing dish.

The food pan can be placed directly on the disk stove, omitting the water pan, and as such can be used for any cooking that requires high heat, such as frying, stewing, etc.

With the feet inserted in the stove as shown in Fig. 1, the disk stove can be used separately for any purpose that a single-burner gas stove can be used, such as frying, grilling, making coffee, and similar operations.

This disk-stove chafing-dish set is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Fig. 2.—Chafing-Dish Set Complete.

Current Electrical News

NORTH ATLANTIC STATES.

SPENCERPORT, N. Y. — F. Tracy, general manager of the Middleport Light & Power Company, and E. W. Barrett, electrician, of Spencerport, have been through all the streets arranging plans and specifications for electric lighting, to be submitted to the Public Service Commission and for letting bids.

HACKENSACK, N. J.—The Board of Public Utility Commissioners has granted the Hackensack Water Company permission to issue stock for $1,000,000 and bonds for $250,000 for improvements and extensions to its plants and system. The work will include an addition to the local pumping plant and doubling the capacity of the filter plant; additional boilers, extensions to the pumping plant, and also filtration plant at New Milford. A.

PENNINGTON, N. J.—The Public Service Electric Company will install a street-lighting system along Pennington Road. A.

NEW BRUNSWICK, N. J.—The Jersey Central Traction Company is planning to appropriate a portion of its recent $5,000,000-mortgage bond issue for extensions to its system in Middlesex and Monmouth Counties, including improvements and enlargements to the properties of the Middlesex & Monmouth Electric Light, Heat & Power Company, a subsidiary organization. A.

SOUTH ATLANTIC STATES.

CUMBERLAND, MD.—The Youghiogheny Power Company and its subsidiary corporation, the charters for which were recently secured, are preparing to construct an immense plant at the headwaters of the Youghiogheny River in Garrett County. The capacity will be 40,000 horsepower. Eastern and foreign capital is said to be interested.

ATLANTA, GA.—The Atlanta Telephone & Telegraph Company will expend $100,000 in improvements and extensions. A. B. Conkin is vice-president.

CARROLLTON, GA.—McCormick and Fahy, Cherokee Life Building, Rome, have been commissioned by the City Council to prepare plans and specifications for a municipal electric light plant.

MANSFIELD, GA.—$5,000 in bonds has been voted for electric lights. Address the mayor for particulars.

ST. MARYS, GA.—The St. Marys Ice & Light Company will establish a lighting plant here, with a capacity of 500 lamps.

NEW SMYRNA, FLA.—A movement is on foot for the building of a trolley line between the St. John's River, either at Enterprise or Blue Spring Landing, and New Smyrna, by the way of Lake Helen. Address W. P. Wilkinson for additional information.

ORANGE CITY, FLA. — The Orange City Telephone Company will construct a telephone system eight to ten miles in length. J. B. Seidel is president and general manager of the company.

NORTH CENTRAL STATES.

DAYTON, O.—In connection with the extension of its lines to Wilmington, O., which is now under way, the Dayton Power & Light Company is considering stringing a branch to Jamestown, O., as well, in connection with a proposition to acquire the power plant at that place. L.

FLOODWOOD, O.—A long-agitated project, that of building a big central electric power station in the Hocking Valley coal fields, is about to be carried out, and Floodwood is to be the site of the improvement. The proposed plant will have a capacity of 40,000 horsepower, which will be furnished mining operations and municipalities within a radius of 75 miles. It is announced that ground will be broken during May. Construction work will be in charge of F. C. Elliott, of Chicago, as representative of the syndicate which is financing the enterprise. Herman Gamper, former superintendent of the Columbus Municipal Light plant, and later of Erie, Pa., will be the engineer in charge. It is expected that several of the units of the generating system will have been completed by next November. Machinery, equipment and methods are to be of the most modern and approved type. J.

YOUNGSTOWN, O.—Investigations are being made by the municipal authorities to ascertain the probable cost and other particulars about the construction of an electric power plant. The Council has passed an ordinance authorizing a bond issue of $3,000 to defray the cost of this investigation. L.

RAVENNA, O.—A bond issue of $3,150 for the purpose of constructing an electric-light plant has been sold and contracts will be let shortly. L.

SANDUSKY, O.—This city is planning to construct an ornamental lighting system in the principal business streets.

SIDNEY, O.—The construction of ten dams in the 140-mile length of the Great Miami River, and the installation of equipment for the generation of an estimated 220,000 horsepower of current, was suggested in an elaborate plan recently laid before the Commercial Club by O. C. Barber, a well-known manufacturer of Akron, O.

CRAWFORDSVILLE, IND.—The Crawfordsville Electric Light & Power Company is in the market for a two-circuit, 100-lamp mercury rectifier and 10 magnetic arc lamps. F. H. Miller is superintendent. G.

EDINBURG, IND.—The Board of Electric Commissioners will purchase two 250-horsepower steel-incased return-tubular boilers. George R. Mutz is superintendent. G.

JEFFERSONVILLE, IND. — A move for a municipal lighting plant was made at a recent meeting of the City Council in Jeffersonville. Address City Attorney Jonas H. Howard for further information.

KIRKLIN, IND.—The Kirklin Telephone Company has been incorporated with a capital stock of $15,000 by William M. Turner, E. P. Turner and others.

RANKIN, ILL.—Business men here are forming a mutual company for the erection of an electric light plant. Scott Johnson is heading the movement. It is expected that the organization will be completed within a short time and that construction work on the plant will be pushed. Z.

EAST LANSING, MICH.—The East Lansing Council has advertised for bids for the installation of a lighting system for the "College City."

GRAND RAPIDS, MICH.—The United Light & Railway Company's budget for the coming year covering contemplated new construction extensions and improvements to various properties, will call for the expenditure of about $1,000,000. The largest expenditures will be on the properties in Iowa, especially at Mason City, Iowa City, Cedar Rapids and on the Tri-City system. Address Ben C. Robinson, 823 Michigan Trust Building, Grand Rapids, for desired information.

NEW ERA, MICH.—The Stearns Light & Power Company, of Ludington, has made a contract with the merchants of New Era to extend its lines to that village and work on the line will be started at once.

SHEBOYGAN, WIS.—The Sheboygan Railway & Electric Company will extend its lines. Address Ernest Gonzenbach, general manager.

HIBBING, MINN.—W. J. Ryder, of the Water and Light Board, has been empowered to consult with Engineer Jackson, who has prepared several sets of plans and specifications for the village on water and light problems relative to the possibility of constructing an up-to-date electric plant in the village.

DAVENPORT, IOWA.—The State Automatic Telephone Company will install a local system utilizing 173 miles of cable. E. H. Moulton, of Minneapolis, is president and B. H. Osborne, Franklin, Pa., secretary.

EARLHAM, IOWA.—Bids will be called for soon for equipment for the electric light plant. Address the village clerk for particulars.

GREELEY, IOWA.—Bonds have been voted for an electric light system. Address the city clerk.

HAMPTON, IOWA.—The Hampton Electric Light & Power Company has been given a franchise for 25 years. The company will now go ahead and equip its plant to furnish power and lights for the adjoining towns. Allison, Alexander, Latimer, Coulter, Bristow, Dumont and other towns are to have the electricity. It will mean the expenditure of a large sum of money and the employment of many men here. There is a material reduction in price to consumers in the new franchise.

WILLIAMSBURG, IOWA.—F. C. Harrington is manager of the company which has been granted a franchise to construct and operate an electric plant here.

CLARKSVILLE, MO.—The city has voted to construct an electric-light plant here. Address the mayor for further information.

KANSAS CITY, MO.—A separate power house will be erected by the Dorn-Cloney Laundry Company at a cost of $10,000. E. Dorn is in charge of plans. M.

KANSAS CITY, MO.—The Kansas Prison Committee, appointed recently by Governor George H. Hodges to make recommendations regarding changes in the State prison at Lansing, advocates in its report the razing of the present power plants and the establishment of a single power plant of sufficient size to generate electric power for all manufacturing work, as well as lights for all prison buildings, the exhaust steam to be used for heating. A high-pressure line also would be run to the prison mine from the central power plant. Removal of all stoves and detached heating apparatus also is recommended. The installation of electrical equipment in all manufacturing plants was also asked by the Commission. Charles Chandler, State Architect, has begun work on the plans for the alterations. M.

KNOBNOSTER, MO.—The Knobnoster Brick, Tile, Light & Power Company has been incorporated with a capital stock of $40,000 by C. A. Harrison, Charles D. Littleton and others.

PARNELL, MO.—The Grant City Electric Company has petitioned for a franchise to furnish electric lights to Parnell. Address Mayor Morgan for general information.

ST. LOUIS, MO.—The Missouri Public Service Commission granted the application of the North Missouri Light & Power Company for the construction of transmission lines to be built to Center, Perry and Frankfort, Mo., at a cost of $35,000, and substations at an additional cost of $15,000, at Keokuk. The company probably will extend its lines to New London, Mo.

SULLIVAN, MO.—The Electric Light & Power Company has been incorporated with a capital stock of $25,000 by W. E. Anderson, E. W. Illien and others.

WILLISTON, N. D.—Farmers of the district lying north of here are intensely interested in the projected construction of an electric line from Williston to Rudser. The line would be extended through Muddy Valley to a distance of about 60 miles northward. Address J. H. Cooper, of Williston.

SOUTH CENTRAL STATES.

ELK FORK, KY.—The Elk Fork Telephone Company has been incorporated with a capital stock of $340 by H. F. Fannin, Walter Skaggs and others.

LEXINGTON, KY.—Lexington proposes soon to have a great "White Way." The plan is for the establishment of no less than eighty-eight high-power electric lamps in the business district of the city, which is now lighted by only eighteen lamps of the familiar arc type. Address the city electrician for general information.

TAYLORSVILLE, KY.—M. F. Cheek contemplates enlarging the electric plant here.

BRISTOL, TENN.—Plans are on foot to electrify the Holston Valley Railway. Address B. L. Dulaney, general manager, Bristol, Tenn., for further information.

HALLS, TENN.—A considerable amount of electrical apparatus will be purchased immediately by the Halls Water, Light & Ice Company, which recently issued bonds for the purchase of the property. Material for transmission will be purchased as well as generators and other equipment for the plant. G.

MEMPHIS, TENN.—If a franchise is granted the Memphis Automatic Telephone Company, work will be begun June 1. Address J. B. Goodbar, who is interested.

MCKINNEY, TEX.—The McKinney, Bonham & Paris Interurban Railway Association has been formed to promote the construction of an interurban line connecting these towns. The road will run *via* Blue Ridge, Leonard and Bonham, and then paralleling the Texas & Pacific Railroad to Paris, 74 miles in all. A survey will be made at once. R. L. Waddill is interested. D.

TUSKEGEE, ALA.—An electric light and power plant will be constructed for the Tuskegee Institute, by the Lord Construction Company, of New York, which was awarded the general contract for that work, and for a heating plant, sanitary sewerage and a sewerage disposal system, by Consulting Engineer Walter G. Franz, of Cincinnati. The work will total about $180,000. L.

WESTERN STATES.

BAKER, MONT.—This town will hold a special election on June 23 upon the approval of granting a special franchise and privilege to E. C. Heinrich for a period of 25 years for the construction, maintenance and operation of an electric light and power plant here.

WEISER, IDAHO.—The Adams County Light & Power Company, of this city, has announced its intentions of erecting a power plant on Rush Creek, near here, in the Weiser National Forest. An application for a permit to construct the plant has been filed with the District Forestry Service in Ogden, Utah. The purpose of the project is to furnish light and power to the towns of Cambridge and Midvale. O.

MOAB, UTAH. — Messrs. C. A. Hammond, of this city, and Joseph W. Christensen, of Fairview, have under consideration the installation of an electric lighting plant in this city. A. V. Richards, of the engineering firm of Caldwell & Richards, of Salt Lake City, has been making an estimate of the cost to install a plant. Mr. Richards has also made preliminary surveys and estimates for the installation of a plant at Monticello.

RENO, NEV.—The Reno Interurban Telephone Company has been incorporated here with a capital stock of $50,000 by O. C. Bates, A. G. Burton, and others.

CHEHALIS, WASH.—Ben Walling, Jr., recently petitioned the City Commissioners for a franchise to enter into the light and power business in this city. He represents sufficient capital to give electrical service to the entire southwest portion of the state. The proposition will probably be placed before the registered voters of the city.

SEATTLE, WASH.—The County Commissioners of King County recently granted the Vashon Electric Company a franchise to conduct an electric light and power business on Vashon Island. The franchise granted covers 56 county roads, and 27 additions on the Island. The Company has 90 days in which to begin construction, and the franchise is void unless wholly in active operation within five years. Homer H. Edwards is president of the concern.

SEATTLE, WASH.—A resolution has been introduced into the City Council, providing for a cluster lighting system, on Madison, Marion and Columbia Streets. The bill is heartily favored by a majority of the Council. H. W. Carroll is city clerk. O.

ANDREWS, ORE.—J. B. Balcomb, executive engineer of the Wild Horse Power & Milling Company, is authority for the statement that his company has completed preliminary surveys for the construction of a hydroelectric power plant to be built near here. Active construction will begin shortly.

LOS ANGELES, CAL.—Lewis E. Degan, of Long Beach, will prepare plans for a city fire-alarm and police-signal system. Address R. H. Manahan, city electrician, for further particulars.

PROPOSAL.

INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., for furnishing interior lighting fixtures until June 5 for the post office at Muskogee, Okla.; until June 10 for the new post office at Minneapolis, Minn.; for the new subtreasury at San Francisco, Cal.; for the new customhouse at Boston, Mass.; until June 12 of a two-story building for the post office at Winchester, Tenn.; until June 13 of a two-story building for the post office at Covington, Tenn.; until June 15 of a two-story building for the post office at Macomb, Ill.; of a two-story building for the post office at McPherson, Kans.; until June 16 of a one-story building for the post office at Gastonia, N. C.; of a two-story building for the post office at Grenada, Miss.; until June 17 of a three-story building for the post office at Jackson, Ky.; of a two-story building for the post office at Burlington, N. J.; until June 18 of a two-story building for the post office at Mount Vernon, Ill., and a one-story building for the post office at Hanford, Cal., all in accordance with drawings and specifications, copies of which can be obtained from the custodians of the sites named or the office of the Supervising Architect.

FINANCIAL NOTES.

Bodell & Company, bankers of Providence, R. I., are offering $850,000 seven-per-cent cumulative preferred stock of the Elmira (N. Y.) Water, Light & Railroad Company. The issue has been approved by the New York up-State Public Service Commission.

The New York Telephone Company, at the annual meeting of the stockholders, elected Otis H. Cutler and Edwin P. Maynard directors, to succeed William H. Woolverton and Theodore F. Miller, deceased.

The Ozark Power & Water Company, of Taney County, Mo., has filed an application with the Missouri Public Service Commission to issue $2,000,000 of the first-mortgage bonds bearing five per cent interest and falling due in 40 years. The bond issue is sought to pay for the improvements already made.

Toronto Railway has announced a new issue of $1,000,000 stock which will bring the total stock outstanding up to the authorized issue of $12,000,000. The new stock will be offered at par to shareholders of record May 11, in the proportion of one share of new for eleven shares of old. At 136 for old stock, rights to the new issue would have a value of $3. The $1,000,000 stock now being offered is the balance of the extra $4,000,000 for which authority was secured three years ago.

At a meeting of the board of directors of the American Water Works & Electric Company, the following permanent officers were elected: H. H. Porter, president; Stuart H. Patterson, of New York, vice-president and treasurer; Harry E. Towle, of Boston, secretary. J. H. Purdy, of Pittsburgh, was elected assistant to the president. An executive committee was named consisting of President Porter, Samuel Insull, Guy E. Tripp, A. H. Wiggin, J. D. Mortimer and H. H. Pierce. It is understood that the executive, financial and operating offices of the company will be located in New York City.

A syndicate headed by A. B. Leach & Company, and the Continental and Commercial Trust & Savings Bank of Chicago is offering $6,000,000 West Penn Traction Company three year six-per-cent secured gold notes at 99 and interest, dated March 2, 1914, callable as a whole during the first year at 101, second year at 100.5 and third year at 100; interest payable March 1 and September 1. The company proposes to spend during 1914 and 1915, including part of the proceeds of this issue, approximately $4,000,000 for betterments, improvements and new construction, against which expenditures its first-mortgage bonds, to be pledged as security for these notes, will be issued. Through direct ownership, stock ownership and leases the compaany controls and operates numerous electric railways, electric lighting and power properties in Western Pennsylvania and adjoining territory in Ohio and West Virginia. Gross operating revenue for the year ended December 31, 1913, was $4,445,629, and net earnings after deducting expenses and taxes were $2,036,858.

The financial organization of the Elmira Water, Light & Railroad Company, a subsidiary of the United Gas & Electric Corporation, has been completed and the company is now on a firm financial foundation and in a position to provide for its requirements in the way of financing for a long time to come. The $1,250,000 one-year debenture notes issued as of May 1, 1913, have been paid off and the funded indebtedness of the company decreased. The funds for the payment of the note issue were secured by the sale of $850,000 seven-per-cent first preferred stock and $617,000 first and consolidated five-per-cent bonds. The former preferred stock has been made a second-preferred and an authorized issue of $3,000,000 first-preferred has been provided of which the above amount was sold. In addition $317,00 of the second-preferred five-per-cent stock has been sold and the proceeds will be used to retire $307,000 Chemug County Gas Company, first-mortgage six-per-cent bonds maturing July 1, 1923. The bonds will be called at 105 and interest on July 1 of the present year. The gas bonds are an underlying issue. The remainder of the authorized first preferred stock will be held to provide for future requirements of the company. The notes just refunded were issued to provide for construction of a new central power station and for the payment of an underlying bond issue.

Gross earnings of the American Light and Traction Company for the year ended March 31, 1914, were $4,442,766 as compared with $4,320,370 for the previous year and $4,104,550 for the year ended March 31, 1912. Expenses made the net earnings $4,291,884, as compared to $4,202,881 the year before and $3,986,193 the year before that. Dividends amounting to $3,603,167 were paid in the year just ended, compared to $3,346,302 in 1913 and $3,112,363 in 1912. The balance added to surplus in the year just ended was $688,717, as compared to $856,579 last year and $873,830 the year before. The total surplus as of March 31, 1914, was $9,577,507, as against $8,888,790 in 1913, $8,032,211 in 1912 and $7,158,380 in 1911.

Combined gross earnings for the Niagara Falls Power Company and the Canadian Niagara Power Company for the year ended December 31, 1913, was $2,742,192, an increase of $254,996 over 1912. Combined net earnings were $2,201,927, an increase of $169,828. Other income made the total net for the year $2,317,985, compared with $2,180,663 for 1912. Deductions were $500,000 for first-mortgage bond interest, $493,560 interest on general or refunding bonds and $1,200 interest on debentures, all unchanged from the year before, and taxes, insurance and Canadian Park rentals of $253,114, a slight decrease, leaving the surplus income for 1913 $1,070,109, compared with $927,857 for 1912, an increase of $142,251, making the total surplus $2,476,351.

Dividends.

	Term	Rate	Payable
Baton Rouge El. pf...S-A		3. %	June 1
Columbus Ry. & Lt..... ..		0.75%	May 25
Federal Lt. & Trac., pf.	Q	1.5 %	June 1
Cent. Ark. Ry. & Lt. pf.	Q	1.75%	June 1
Kings Co. E. L. & P...	Q	2 %	June 1
Nor. Texas Elec.....	Q	1.75%	June 1
Port'd Ry. Lt. & Pow..	Q	1 %	June 1
White Eng. Corp. pf...	Q	1.75%	June 1

Reports of Earnings.

DETROIT UNITED.

	1914	1913
March gross .....$	963,606	$1,029,289
Net	281,732	345,854
Total income	308,657	363,232
Charges and taxes.....	180,629	180,309
Surplus	128,028	182,924
Three months gross...	2,755,492	2,913,589
Net	777,773	928,829
Total income	856,912	987,450
Charges and taxes....	641,522	537,413
Surplus	315,390	450,037

AMERICAN DISTRICT TELEGRAPH COMPANY.

The report of the American District Telegraph of New Jersey for the year ended December 31, 1913, shows a balance available for dividends of $642,584, equal to 6.44 per cent earned on $9,965,351 capital stock, against 8.73 per cent on the same stock the previous year. The income account compares as follows:

	1913	1912
Gross income .....$	2,391,818	$2,351,346
Operating expenses ...	1,749,235	1,481,029
Balance .....$	642,584	$ 870,317
Dividend	398,556	398,554
Surplus .....$	244,028	$ 471,763

NEW ENGLAND TELEPHONE COMPANY.

The report of the New England Telephone & Telegraph Company for the year ended december 31, 1913 shows net earnings of $3,785,162, against $3,468,696 the previous year. The income account compares as follows:

	1913	1912
Gross earnings .....$	17,672,945	$16,324,305
Operating expenses .	7,293,751	6,320,173
Taxes	985,921	1,004,346
Current main	2,086,688	2,379,638
Depreciation	3,521,423	3,151,451
Total expenses ...$	13,887,783	$12,855,609
Net earnings .....$	3,785,162	$ 3,468,696
Interest	616,674	345,581
Balance net profit.$	3,168,488	$ 3,123,115
Dividends	3,015,987	2,810,859
Deduction from surplus	14,920	.....
Surplus .....$	137,500	*$ 31,256

*The company's surplus was charged during the year 1912 with the $1,000,000 credited to employees' benefit fund and the unamortized portion of discount on bonds sold $296,453; while it was credited the balances in employees' retired pay and accidents $135,204, and the surplus earnings for the year as shown above $312,356; these charges and credits resulted in a net decrease of $848,992 in the surplus account.

At the annual meeting of the New England Telephone & Telegraph Company all the officers were re-elected. Henry W. Keyes, of North Haverhill, N. H., was elected to the board of directors in place of William H. Elliot, resigned. The date of the annual meeting was changed to the Wednesday after the third Tuesday in February.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	May 11	May 4
American Tel. & Tel. (New York)	122	121¼
Commonwealth Edison (Chicago)	134½	133½
Edison Electric Illuminating (Boston)	247	247
Electric Storage Battery common (Philadelphia)	52	49
Electric Storage Battery preferred (Philadelphia)	52	49
General Electric (New York)	145½	147½
Kings County Electric (New York)	120	120
Manhattan Transit (New York)	1	1
Massachusetts Electric common (Boston)	10	9½
Massachusetts Electric preferred (Boston)	58	57
National Carbon common (Chicago)	108	105
National Carbon preferred (Chicago)	118	119
New England Telephone (Boston)	135	136
Philadelphia Electric (Philadelphia)	25½	25½
Postal Telegraph and Cables common (New York)	78¼	76½
Postal Telegraph and Cables preferred (New York)	67¾	68
Western Union (New York)	61¼	61½
Westinghouse common (New York)	73¾	74
Westinghouse preferred (New York)	120	119

PERSONAL MENTION.

MR. W. ROLLINSON WHITTINGHAM has been elected president of the Millburn Electric Company, Millburn, N. J.

MR. B. K. HOWARD, who has been associated with the General Electric Company for several years past, has resigned to join the Texas Power Company, at Dallas, Tex.

MR. H. F. HOLLAND, representative of the Simplex Electric Heating Company, Salt Lake City, Utah, is on a one-month trip to the Pacific Coast, and will include Los Angeles.

MR. W. J. JOHNSTON, of Chicago, Ill., has joined the sales force of the Connecticut Telephone & Electric Company, Meriden, Conn., manufacturers of the well known Connecticut ignition products.

MR. JAMES P. DUSENBERRY, retiring treasurer of the Public Service Corporation, Newark, N. J., was a guest of honor at a dinner given by the executive organization of the corporation at the Washington, Newark, Tuesday evening, May 5.

MR. EMIL GRUENFELDT, chief engineer for the Baker Motor Vehicle Company, of Cleveland, O., sailed from New York last week to spend about two months abroad. Mr. Gruenfeldt will take a brief vacation in Germany, and will also make an investigation of recent foreign motor-car developments.

MR. MELCHER EKSTROMER, electric vehicle specialist with the Electric Vehicle Company, Denver, Colo., is spending a short time in Salt Lake City in connection with some large deals on electric trucks under consideration by two of the large department stores of that city.

MR. D. W. SNYDER, of Clinton, Ill., has been appointed manager of the Jefferson City (Mo.) Light, Heat & Power Company, succeeding MR. A. H. R. JACKSON, who has been transferred to Oskaloosa, Iowa. Besides being prominent as a manager in electrical circles, Mr. Snyder has gained a reputation as a builder of power plants.

MR. A. C. SOELLNER, who has been in the billing department of the General Electric Company at Chicago, Ill., has been made chief clerk at the Kansas City, Mo., branch of the company. He has been with the company for five years. He succeeds MR. R. H. McCURDY, who has resigned because of ill health, after eight years' service.

MR. HARRY H. GERHARD, president of the C. A. Wood Preserver Company, St. Louis, Mo., was married to Miss Elizabeth D. Owsley, a Kentucky girl, at Hannibal, Mo., on April 18. Mr. and Mrs. Gerhard have many friends in the electrical industry. They are touring the States on their honeymoon trip and will reside in a suburb of St. Louis upon their return.

MR. S. R. INCH, general superintendent of the Utah Power & Light Company, and MR. W. R. PUTNAM, new business manager of the same company, together with MR. C. A. COHN, superintendent of power stations, also of the same company, will attend the convention of the National Electric Light Association, to be held early in June in Philadelphia, Pa.

MR. GUY E. TRIPP, who was recently elected president of the West Penn Traction Company, made an inspection trip over the lines of the company last week and is reported to have been well pleased with conditions. He was accompanied by Mr. W. Fish, the new controller of the West Penn properties, and Mr. H. S. Swift, the new treasurer. Mr. Fish succeeds Mr. J. B. Van Wagener and Mr. Swift takes the place of C. W. Scheck and Byron Trimble.

MR. WILLIAM C. TREGONING has established an office and laboratory at 813 Prospect Avenue, S. E., Cleveland, O., where he intends devoting his entire attention to the development of mechanical and electrical devices, but more particularly to fittings for electric lighting. Mr. Tregoning organized The Tregoning Electric Manufacturing Company in 1907, and was its president and general manager until March 1, 1914.

MR. DOUGLAS I. McKAY has been appointed assistant to the president by the directors of J. G. White & Company, Incorporated. Mr. McKay will give special attention to the problems connected with the development of the organization and its various associated and affiliated companies and will assist also with other general executive duties. Mr. McKay is a graduate of the United States Military Academy at West Point, N. Y., and has consequently had a general engineering education. He was former police commissioner of New York City, and his education, together with his experience in matters of organization gained through his association with the police department and elsewhere, will make him particularly useful to the organization he has just joined.

MR. GEORGE H. KELLY, secretary of the Baker Motor Vehicle Company, of Cleveland, O., was host at the Union Club, Cleveland, May 6, to a gathering of 12 men well known throughout the country for their connection in the electrical business. The guest of honor was MR. FRANK W. SMITH, president of the Electric Vehicle Association of America, who was visiting the Baker Factory. Other guests were Messrs. S. E. Doane, of the National Electric Light Association; L. P. Sawyer, manager of the Buckeye Lamp Company; C. L. F. Wieber, president of the Rauch & Lang Carriage Company; George S. Milner, general manager of the Erner Electric Company; Mathias Turner, commercial agent of the Illuminating Company; T. P. Cagwin, commercial manager of the Cleveland Telephone Company; H. B. Gay, manager of the Cleveland office of the Electric Storage Battery Company; George D. Smith, district sales agent of the General Vehicle Company, New York; Mr. Ayers, manager of the truck department, General Motors Company; and Hayden Eames, president of the Standard Electric Car Manufacturing Company.

OBITUARY.

MR. FRANCIS J. BEGG, a contractor, died recently in his home in Waverly, Md., of cancer of the brain. Mr. Begg was prominent in the electrical world, having had an important part in the construction of some of the electric railroads in this state.

MR. JOHN FOREST DILLON, general counsel for the Western Union Telegraph Company, died in New York on May 6, after serving that company since 1882. Mr. Dillon was 83 years of age. A son Mr. H. P. Dillon, of Topeka Kan., survives. Interment was at Davenport, Iowa.

NEW PUBLICATIONS.

ELECTRIC FURNACES.—The Bureau of Mines, Washington, D. C., has issued Bulletin 67 entitled "Electric Furnaces for Making Iron and Steel," by Dorsey A. Lyon and Robert M. Keeney. This deals with the use of the furnace for both pig-iron manufacture and steel-making. The various forms of furnace used for these purposes are described and illustrated, and some costs of operation are given.

NEW INCORPORATIONS.

DETROIT, MICH.—Union Electrical Construction Company has been incorporated with a capital stock of $50,000 by Louis H. and Elsie M. Sass, and Henry C. Pappert.

KANSAS CITY, MO.—The Ohio Electric Kansas City Company has been incorporated with a capitalization of $2,500. The incorporators are Charles R. Guibor, K. C. H. Loechler, and Brown Harris.

WILMINGTON, DEL.—The Empire Vehicle Company has been granted a charter by the state of Delaware. The purpose of the company is to manufacture and sell electric vehicles. N.

ELKHART, IND.—Sevison Electric Company has been incorporated with a capital stock of $10,000 to deal in electrical equipment. The incorporators are M. E. Crow, J. B. Fitch and L. J. Sevison.

CHICAGO, ILL.—The Lucas Signal & Control Company, of Chicago, capitalized at $10,000, has been incorporated by Paul Pierce, Everett N. Murphy and Joseph N. Pierce, to manufacture and deal in electrical appliances. Z.

CHICAGO, ILL.—The Chicago Electric Shoe Shining Machine Company; capitalized at $2,500, has been incorporated by E. A. Biggs, E. S. Carr and J. Rigney, to do a general advertising hardware and electrical business. Z.

NASHVILLE, TENN.—Detroit-Nashville Construction Company has been incorporated with a capital stock of $100,000 by Cameron Currie, W. E. Steger, A. W. Willis, W. O. Vertrees, William J. Pulling, Urey Howard and Strathearn Hendrie.

BLOOMFIELD, N. J.—R. K. Mickey Company has been incorporated to manufacture incandescent electric lamps. The capital stock is $50,000 and the incorporators are D. McNeill, of New York City; M. L. Mickey and R. K. Mickey, of Bloomfield.

WILMINGTON, DEL.—National Electric Distributer Corporation has been incorporated to manufacture and deal in machinery for generation of electricity. The capital stock is $500,000 and the incorporators are H. E. Latter, W. J. Maloney, O. J. Reichard, Wilmington.

MANHATTAN, N. Y.—Willis Mitchell Company, Incorporated, has been incorporated with a capitalization of $100,000. The incorporators are A. B. Britton, J. J. Jensen, Jr., W. P. Powell, all of New York City. The company will carry on business of light, heat and power system.

ROCK ISLAND, ILL.—M. & F. Electrical Company has been incorporated with a capital stock of $2,500 for the purpose of manufacturing and dealing in all kinds of electrical apparatus, machinery, etc. The incorporators are Martin McNealy, William McNealy and William Fox.

DATES AHEAD.

American Institute of Electrical Engineers. Annual meeting, New York, N. Y., May 19. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York City.

Association of Railway Telegraph Superintendents. Annual meeting, New Orleans, La., May 19-22. Secretary, P. W. Drew, 112 West Adams Street, Chicago.

Southwestern Electrical and Gas Association. Annual meeting, Galveston, Tex., May 20-23. Secretary, H. S. Cooper, Dallas, Tex.

Cleveland Electrical Exposition, May 20-30. Manager, William G. Rose, Wigmore Coliseum, Cleveland, O.

Missouri Electric, Gas, Street Railway and Waterworks' Association. Annual convention, on board steamer *Quincy* en route from St. Louis to Keokuk, Iowa, and return, May 21-23. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

National District Heating Association. Sixth annual convention, Rochester, N. Y., May 26-28. Secretary, D. L. Gaskill, Greenville Electric Light & Power Company, Greenville, O.

Indiana State Electrical Contractors' Association. Convention, Indianapolis, Ind., May 28-29. Secretary, George Skillman.

American Institute of Electrical Engineers. 296th meeting, Pittsfield, Mass., May 28-29.

National Electric Light Association. Annual convention, Bellevue-Stratford Hotel, Philadelphia, Pa., June 1-5. General secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

Oregon Electrical Contractors' Association. Annual meeting, Portland, Ore., June 8-9. Secretary, J. C. Green, Portland, Ore.

American Society of Mechanical Engineers. Spring meeting, St. Paul, Minn., June 16-19. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York, N. Y.

American Institute of Chemical Engineers. Sixth semi-annual meeting, Troy, N. Y., June 17-20. Secretary, J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

Michigan Section, National Electric Light Association. Annual convention cruise leaving Detroit June 17, for the Thousand Islands and intermediate points, returning June 20. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

Minnesota Electrical Contractors' Association. Annual Convention, St. Paul, Minn., June 22.

American Institute of Electrical Engineers. Thirty-first annual convention, Cadillac Hotel, Detroit, Mich., June 22-26.

National Electrical Contractors' Association of the United States. Annual convention, Cadillac Hotel, Detroit, Mich., July 15-16. Secretary, W. H. Morton, 40 Martin Street, Utica, N. Y.

Electric Vehicle Association of America. Fifth annual convention, Philadelphia, Pa., October 19-21. Secretary, Albert Jackson Marshall, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

American Electrical Works, Phillipsdale, R. I., has issued its May price list covering bare, weatherproof and rubber-covered wires and cables, lamp cords, annunciator wire, galvanized iron wire, etc.

Harvey Deschere & Company, manufacturer of the Argus miniature electric sign, announces its change of address from 50 Church Street, New York, N. Y., to 1507 Garden Street, Hoboken, N. J.

The Appleton Electric Company, Chicago, Ill., has just issued a very neat catalog, No. 7, entitled "Unilets—Conduit Fittings," which fully lists and illustrates its complete line of unilets, outlet boxes, etc.

The Hazard Manufacturing Company, New York, N. Y., manufacturer of all kinds of wire rope and insulated wires and cables, announces that its office and warehouse have been removed from 50 Dey Street to 533-541 Canal Street.

The United States Light & Heating Company, Niagara Falls, N. Y., announces that the New York sales office and service station, formerly located at 210 West Fiftieth Street, has been transferred to the Locomobile Building at 16 to 24 West Sixty-first Street.

F. W. Wakefield Brass Company, Vermilion, O., is sending out to fixture dealers some new folders calling attention to marked advantages of its standard universal or interchangeable lighting fixtures, also to its new line of Mellowlites, convertible direct and indirect fixtures.

Electrical Engineers Equipment Company, Chicago, Ill., has moved into its new building at 711-715 West Meridian Street. The entire structure is occupied by the firm, giving it an increase of floor space to nearly 29,000 square feet. This will enable the company to carry on a more extensive business.

The Universal Battery Company, Chicago, announces the completion of its new factory building which is designed especially for making its various lines of batteries. The new building will be more spacious, which has been made necessary by the increasing demand for Universal batteries and lighting systems. The new location is at 3410 to 3424 South La Salle Street.

The Standard Paint Company, 100 William Street, New York, N. Y., announces the removal of its Boston office from 70 Kilby Street to 6 Beacon Street. The old offices on Kilby Street have been occupied by the Standard Paint Company for about 18 years, and it is with a certain feeling of regret that the change is made, although the increased volume of business necessitates more commodious quarters.

Belden Manufacturing Company, Chicago, Ill., has just issued bulletin No. 1006, which gives full data on its complete line of standardized bare-copper cables and braids manufactured. A very complete range of sizes is shown, including an entirely new line of cables designated as "Hawser-lay." These cables are stranded and laid up by a method that gives the maximum flexibility. The entire line shown in this bulletin has a wide range of applications in the electrical field.

The Bissell Engineering Company, 426 Board of Trade Building, Indianapolis, Ind., has been awarded the appraisal work for the Browne-Mills Electric Company, North Manchester, Ind. This work comprises the complete appraisal of the entire plant, including the power house, transmission lines, etc. While there has been no agitation as to change of rates, the company desires to get a complete valuation of its property in accordance with the requirements of the Commission.

Diehl Manufacturing Company, Elizabeth, N. J., has recently issued bulletin No. 6, devoted to Diehl motor-driven exhaust fans. These are made with several different types of blades and in sizes ranging from 9 to 48 inches in diameter of the table wheels. The fans serve for several ventilating purposes and are of high efficiency. The bulletin describes their construction and gives complete data and dimension diagrams. Copies of the bulletin can be had by writing the company.

Bonestead Electric & Manufacturing Company has established itself at 215 First Avenue North, Minneapolis, Minn. The company will manufacture motors up to 50 horsepower, as well as switchboards and panelboards. It will handle a complete line of generators and electrical machinery. James T. Bonestead is at the head of the company. He has been in the electrical business since 1881, when he installed the first dynamo in Minneapolis. Twenty-three years ago Mr. Bonestead organized the Electric Machinery Company, from which concern he recently resigned to enter the field with his new company.

The Multi-Refillable Fuse Company, Chicago, Ill., is now comfortably located in its new plant at 723 West

Fulton Street. In connection with its expanding business the company announces that the Mid-City Sales Company, at 811 West Adams Street, Chicago, will act as selling agents for the states of Wisconsin, Illinois, Nebraska, Kansas and the northern part of Indiana. The Mid-City Sales Company is under the direct management of S. R. Kalisch, until recently connected with the Thomas G. Grier Company as special representative. Associated with Mr. Kalisch are several men of long experience in the electrical industry.

The Robbins and Myers Company, Springfield, O., announces that ground has recently been broken for the construction of a new factory building to take care of its rapidly growing output. This building will be immediately south of and adjoining the new shops which were completed a little less than a year ago. It will be of reinforced concrete and will contain four stories and basement, the ground area being 60 x 265 feet. The Philadelphia office has recently been removed from 206 Bailey building to 606-608 Bellevue Court building, 1418 Walnut street. The new office will provide greatly increased facilities for handling the business of this branch.

General Insulate Company, 1008-1014 Atlantic avenue, Brooklyn, N. Y., manufacturer of Insulate composition receiver cases, mouthpieces and electrical insulations, is rapidly recovering from the effects of the fire on April 25. This fire almost destroyed its power plant, finishing rooms and part of its press rooms and machine shops, and a continuous three-day rainfall made it almost impossible to do any work in its unroofed main factory building. Nevertheless, within four days after the fire the company had taken a physical inventory of its entire plant, covering 2,700 different classifications. On May 3 its die shops, finishing rooms, etc., were installed in temporary quarters, and within ten days the company began to ship many of its products to various trades throughout the country. Reconstruction work was started on the old plant almost immediately after the fire, and it is expected that before the end of May the plant will be in full operation.

The Westinghouse Electric and Manufacturing Company has recently issued a number of publications. Catalog section No. 3,082 deals with motor-driven pumps. This publication has an attractive art cover and is profusely illustrated with views of installations of pumps of various kinds and performing duties of a varied nature. Tables are given showing the frictional heat in wrought iron pipe, horsepower for pumping, standard dimensions of pipe, and atmospheric pressures, equivalent heads and suction lifts. Folder No. 4,281 entitled "Ironing a Pleasure," describes the household and traveler's iron. Westinghouse 56-inch direct-current ceiling and column fans are described in Folder No. 4,282. Leaflet No. 3,719 describes and illustrates Type-KD battery-charging panels for two-wire systems, 50 to 250 volts, for lighting and electric-vehicle charging. Typical diagrams of connections are shown. Type-I oil switches are described in leaflet No. 3,745. This type of oil switch is intended for use on direct or alternating-current series-lighting circuits and for controlling inductive loads of small capacity. Leaflet No. 3,512-A describes electric auto-starters for squirrel-cage motors. The construction of this device is fully described and illustrated as is also the overload relay with which it is equipped. Leaflet No. 2,364 describes direct-current Type-K crane motors. These motors are designed for intermittent varying-speed service where high starting torque is required such as cranes, hoists, coke-charging machines, etc. Folder No. 4,172 describes bell-ringing transformers. On the back page is shown a comparison of the old method of using batteries and how they are subject to breakage; with the new way involving the use of transformers. Section No. 3,164, covering motor-driven laundry machinery, has also been issued. This forms one of the series of publications being issued on motor-drive in the industries.

Record of Electrical Patents.

Issued by the United States Patent Office, May 5, 1914.

1,095,182. Trolley Harp or Head. J. J. Barnick, Bloomsburg, Pa. A detachable quick-change head.

1,095,214. Electric Cooker. P. Johnson, Winnipeg, Manitoba, Canada. An open-topped cylindrical pot with cooking grate and coreless heating coils supported on the heat-insulated bottom.

1,095,235. Electric Signal for Hay Presses. C. Schade, Cropsey, Ill. Roller contacts close the circuit as they engage the metallic frame of the dividing blocks.

1,095,244. Combined Priming and Sparking Plug. C. G. Tate, Chicago, Ill., assignor to United Motor Equipment Co. Covers details.

1,095,273. Testing Device for Gas Engines. W. C. Force, North Plainfield, N. J. Was a number of handles each with a central member adopted to be placed in circuit with the spark plug and a common conducting member adopted to be grounded on the frame.

1,095,279. Electric Switch. R. C. Hull, Germantown, Pa. A push-rod operates the pivoted contact arm.

1,095,284. Instrument for Locating Breaks and Grounds in Electric Wires. M. J. Myers, deceased; L. O. Myers, Syracuse, N. Y., administratrix. Includes a fixed primary coil and a number of oppositely acting secondary coils movable axially.

1,095,296. Lighting Fixture. M. P. Stevens, East Orange, N. J. A combined socket cover and shade holder.

1,095,300. Arc Welding Apparatus. T. Varney, assignor to Westinghouse Electric & Mfg. Co. Includes a resistance-varying motor having its armature in shunt with welding arc.

1,095,321. Illuminated License Number. W. T. Fisk, Detroit, Mich. Includes an electric lamp.

1,095,324. Method of Making Reinforcing Bars. N. L. Hall, Los Angeles, Cal. Consists in twisting the bar along its whole length and simultaneously electrically hardening separate portions to cause them to resist twisting action.

1,095,328. Plating Apparatus. J. H. Jordan, St. Louis, Mo. Special electroplating tank.

1,095,329. Cable Telegraphy. I. Kitsee, assignor to American Telephone & Telegraph Co. His two sources of current connected in the line transmission, but in opposition to each other.

1,095,331. Field-Magnet Winding for Dynamo-Electric Machines. B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. Current is supplied to the two parts of the field in parallel to produce main magnetic poles, and in series to produce commutating poles.

1,095,342. Wireless Receiver. H. Merton, London, England. Audible signals from receiving circuit make record on phonograph.

1,095,354. Telephone Transmitter. J. Redding, assignor to F. H. Lord, trustee, South Weymouth, Mass. Has a number of cells containing the granular resistance material.

1,095,358. Call Box. H. O. Rugh, assignor to Hall Switch & Signal Co. Covers details of selective mechanism.

1,095,379. Röntgen-Ray Apparatus. S. Cabot, Brookline, Mass. Has a number of series contacts arranged to minimize sparking.

1,095,388. Automatic Engineer's Signal. L. Edwards, Aurora, Ill. Covers mechanical device operating bell and lamp in engine cab.

1,095,392. Electrically Heated Waving Tongs. L. Frey, Munich, Germany. Has electric heating coils in tongs.

1,095,405. Heating Apparatus. C. Kratt, Glasgow, Scotland. Switch controlling electric heating circuits is mechanically attached to the valve handles.

1,095,425. Process and Apparatus for the Production of Long Continuous Electric Arcs. O. Schönherr and J. Hessberger, assignors to Norsk Hydroelektrisk Kvaelstofaktieselskab, Christiania, Norway. Has two tubular electrodes and means for creating a continuous draft.

1,095,426. Process for Producing Long Continuous Electric Arcs. O. Schönherr and J. Hessberger, assignors to Norsk Hydroelektrisk Kvaelstofaktieselskab. A modification of 1,095,425, using one tube with two electrodes.

1,095,427. Means for the Production of Long Continuous Electric Arcs. O. Schönherr and L. Hessberger, assignors to Norsk Hydroelektrisk Kvaelstofaktieselskab. A modification of 1,095,425, having a conical electrode.

1,095,437. Spark Coil. C. R. Underhill, assignor to Detroit Coil Co., Detroit, Mich. A vibrating armature with tension adjusting support.

1,095,439. Ground Detector for Insulators. J. Wahn, Austria-Hungary, Vienna. Conductor placed between insulator and a secondary insulator permits testing for grounds.

1,095,453. Motor Mechanism. C. W. Coleman, assignor to The Hall Switch & Signal Co. Motor with electromagnetic clutch for operating signal.

1,095,473. Apparatus for Treating Articles with X-Rays. F. S. Smith, as-

signor to Electri-Sterilizing Co., Dover, Del. Electric motor rotates X-ray tube.

1,095,474. Snap Electric Switch. J. A. Smith, assignor to The United States Electrical Tool Co., Cincinnati, O. A snap switch having a reciprocating operating handle.

1,095,491. Remote Switch Control for Electrical Circuits. P. C. Butte and C. F. Butte, San Francisco, Cal. Has magnetic tripping device.

1,095,507. Motor-Controlling System. W. D. Lutz, assignor to Otis Elevator Co., Jersey City, N. J. Elevator motor with parallel armature circuits, one of which has a speed-controlled resistance.

1,095,525. Call Box. H. O. Rugh, assignor to Hall Switch & Signal Co. An impulse selective calling device.

1,095,533. Portable Light. L. J. Starr and W. H. White, assignors to The Badger Brass Mfg. Co., Kenosha, Wis. Incandescent lamps placed inside of reflecting shell.

1,095,539. Calling Device for Telephone Exchanges. C. A. Anderson, assignor to Anderson Electric and Mfg. Co., Wichita, Kans. Combined signal and calling device for automatic telephones.

1,095,541. Printing Telegraph System. C. G. Ashley, assignor to General Engineering and Construction Co., Limited, Toronto, Canada. Selective contacts operate printing elements.

1,095,557. Electric Vaporizer. C. L. Davis, Detroit, Mich., assignor of one-half to H. W. Frost. Has electric heating unit.

1,095,586. Alternating-Current Motor. B. McCullum, Lawrence, Kans., assignor of one-half to M. E. Rice. Controlling apparatus for single-phase motor.

1,095,593. Fluid-Pressure System for Operating Bulkhead Doors. F. J. Pike, and H. Neville, assignors to J. Stone & Company, Limited, Deptford, England. Has electromagnetic control of main valves.

1,095,609. Purifying Electrolytes. F. von Kügelgen, F. von Bidder and G. O. Seward, assignors to Virginia Laboratory Co., New York, N. Y. Molten salts are purified between electrodes at high temperatures by electrolysis.

1,095,632. Dynamo-Electric Machine. C. J. Heineman and A. H. Hensley, Chicago, Ill.; said Heineman assignor to said Hensley. An automobile engine-generator, the voltage of which is kept constant at varying speed by automatically varying length of armature under pole faces.

1,095,645. Vaporizer for Internal Combustion Engines. E. Koster, Yonkers, N. Y. Has electric heating coils.

1,095,648. Armored Conduit or Conductor. G. A. Lutz, assignor to American Circular Loom Co. Armored conduit with a spiral surface in the grooves of which is inserted a binding wire. (See cut.)

1,095,655. Elective Signaling Means. J. McFell, Chicago, Ill. A step-operated selective signal-receiving device.

1,095,656. Ignition Timer for Reversible Gas Engines. W. R. McKeen, Jr., assignor to McKeen Car Co., Omaha, Neb. Includes automatic control of circuit breaker upon reversal of engine.

1,095,666. Telephone System. E. R. Parker and E. R. Corwin, Chicago, Ill.; said Corwin assignor to said Parker. Covers details.

1,095,696. Engine-Starting Apparatus. J. Bijur, assignor to Bijur Motor Lighting Co., New York, N. Y. Motor starter with automatically operated clutch for use with internal combination engines.

1,095,722. Secondary or Storage Battery. B. Ford, Philadelphia Pa. Support for rubber walls of battery designed to minimize breakage of jars due to brittle rubber.

1,095,733. Ground Connector. E. Klein, New York, N. Y. A ground clamp with special contact-making point. (See cut.)

1,095,648.—Armored Conduit.

1,095,748. Electrolytic Apparatus. W. Thum, Hammond, Ind. Includes supporting means for electrodes independent of tanks.

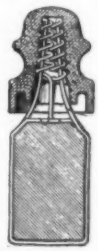
1,095,744. Toilet Box. Frederick Knapp Smith, New York, N. Y. Electrodes inserted through slots in bath.

1,095,811. Electric Low-Level Signal for Tanks. O. C. Carr, Lansing, Mich. A float-operated switch inclosed in a tube.

1,095,733.—Ground Connector.

1,095,816. Crossing Arrangements for Block Signals Systems. M. Conrad, Adrian, Mich., and W. G. Kelly, Winslow, Ariz. Track-operated signal system for railroad crossings designed to show presence of train on crossing tracks.

1,095,844. Extensible Electric-Light Fixture. F. Garrecht, Idaho City, Idaho. Lamp supported by lazy tongs which also support lamp cord.



1,095,860.—Insulator Holder.

1,095,845. Electric Mail Box. P. O. Gaudreau, Burlington, Vt., assignor of one-half to E. L. Smith. Electric bell indicator for mail box operated by insertion of mail in box.

1,095,860. Insulator Holder. H. C. Heffner, Martinsburg, W. Va. A two-part spirally wound wire insulator pin. (See cut.)

1,095,863. Railway Safety and Recording Device. F. Hudson, assignor to Recording Safety Device Co., Phoenix, Ariz. A magnetically operated air-brake control device.

1,095,893. Process of and Apparatus for Treating Water. C. P. Landreth, Philadelphia, Pa. Electrolytic purifier for water involving use of aluminum electrodes.

1,095,902. Rear-End Signal for Vehicles. C. F. Marston, Cedarhurst, N. Y. Electromagnetically operated rear-end vehicle signal designed to make known vehicle intended motion.

1,095,915. Safety and Signaling Device for Railroads. D. C. Newton, assignor of one-half to M. Lindeman. Signal and bell operated by short-circuiting contacts between tracks.

1,095,935. Electrically Controlled Air-Releasing Valve for Train Pipes and the Like. T. H. Sheldon, assignor of one-half to F. Herz. Solenoid operated air-release valve.

1,095,949. Fire-Alarm Circuit Closer. B. Trent, Clifton, N. J. Suspended ring designed to be released by heat and complete circuit.

1,095,967. System of Propulsion. J. T. Lister, assignor to The Turbin Motor Electric Car Co. Includes automatic control of floating storage battery.

1,905,982. Railway Block Signal and Train Controlling System. G. R. Guild, United States Army. Include use of one sectionalized rail and one auxiliary sectionalized rail.

1,095,990. Trolley. C. A. Soule, Canandaigua, N. Y. Has insulating collars carried by the arms of the lamp and means for conducting the current around the insulated portions.

Patents Expired.

The following United States electrical patents expired May 11, 1914:

582,187. Telephone-Controlling Device. T. A. Dull, Chicago, Ill.

582,200. Telephone Transmitter. R. P. Green, Columbus, O.

582,218. Electric Motor. J. A. Mosher, Chicago, Ill.

582,237. Electrically Propelled Agricultural Implement. H. Schimpff, Halle-on-the-Saale, Germany.

582,259. Electric Trolley Device. W. M. Brown, Johnstown, Pa.

582,262. Electrically Actuated Switch. J. Bryan, Pittsburgh, Pa.

582,269. Armature for Dynamo-Electric Machines. E. P. Clark, New York, N. Y.

582,273. Electrical Striking and Alarm Attachment for Clocks. B. DeWitt, Terra Alta, W. Va.

582,303. Electric Switch. W. J. Newton, New York, N. Y.

582,378. Carbon for Arc Lamps. J. D. Smith, Washington, D. C.

582,396. Insulator. W. G. Schnee, Pueblo, Colo.

582,461. Electrical Indicating Device. W. W. Dean, St. Louis, Mo.

582,462. Electric Circuit Terminal. E. N. Dickerson, New York, N. Y.

582,464. Electric Contact. C. C. Dusenbury, Lake Mahopac, N. Y.

582,481. Fastening Means for Core Plates of Electrical Machines. E. E. Nolan, Wilkinsburg, Pa.

582,493. Electric Meter. G. A. J. Telge, Oldenburg, Germany.

582,494. Core for Electrical Machines. G. Westinghouse, Pittsburgh, Pa.

582,512. Mast-Arm for Electric Lamps. A. Wright, Providence, R. I.

582,513. Telephone Transmitter. H. C. Alexander, Bonham, Tex.

582,522. Telephone. C. F. Dunderdale, Chicago, Ill.

582,578. System of Electrical Intercommunication. E. A. Clark, Sioux City, Iowa, J. P. Ellacott and W. J. O. Johnson, Chicago, Ill.